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SECTION C

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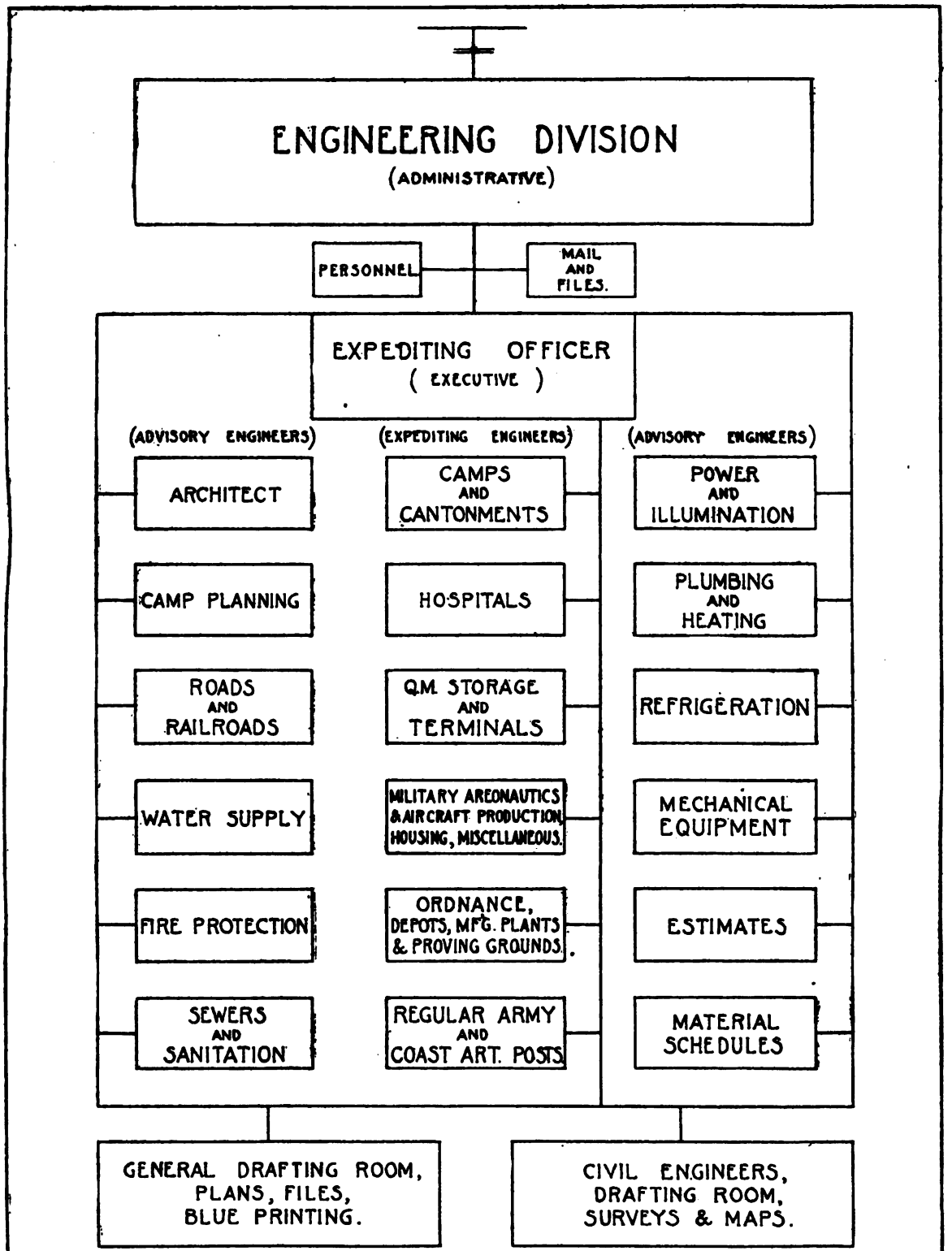

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OF THE
CONSTRUCTION DIVISION OF THE ARMY

AS OF NOVEMBER 12, 1918

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MANUAL

OF THE

CONSTRUCTION DIVISION OF THE ARMY

SECTION C

ENGINEERING DIVISION

FOREWARD

The technical section of the Manual for the Construction Division has been compiled for the purpose of making generally available the fundamental principles and standards which have been adopted for emergency construction. The standards and the resulting drawings and specification data are not furnished as solutions of the various problems, nor as conforming to peacetime commercial standards, for they have been influenced by the emergency conditions requiring speed, economy of construction, and the conservation of certain materials.

The Manual is intended for the guidance of forces engaged in the preparation of plans for emergency construction work, also to aid constructing officers in interpreting the plans which are furnished for a particular project, and in preparing details consistent with principles governing design. It will also serve as a guide to the constructing officer who, being isolated from the central office, may determine for himself the designs and methods required to meet the needs of his particular problem.

It is desirable that constructing officers avail themselves of drawings already prepared, which are available for almost any sort of structure that may be needed for emergency use, and many that are suitable for permanent use. Reference should therefore be made to the lists of standard and special drawings included in this Manual before preparing others.

The text for this Manual was prepared for war emergency use during the active war period. At the time the armistice was signed the text was largely completed, and the material was considered to be of sufficient value to warrant its publication in the form in which it was prepared. The methods, details and data here furnished are not considered as representing the only way, nor the best way, in which such work can be done, but they do represent what was actually used successfully during the war.

No attempt is made to give complete specifications, and such specifications as are included in this Manual are not to be considered as adequate in connection with lump sum contracts; but are mainly for use in connection with the emergency form of contract, which was on a cost plus percentage basis, and which permitted changes in plans without disturbing the contract relations.

GENERAL FUNCTIONS

PRELIMINARY NOTES.

It is not practicable, nor is it desirable, for the Engineering Division to furnish complete detail plans for all projects, and consequently the work of this Division consists chiefly in establishing fundamental formulas, principles, policies and standards to govern all engineering work (whether done by field forces or by outside agencies), and in preparing drawings and specifications for general application. The general functions of this Division are indicated by the following:

(a) Standard drawings and specifications have been prepared for camp plans, hospital and miscellaneous buildings, plumbing, sewers, sewage-disposal plants, heating, water supply, electric lighting, refrigeration, roads, railroads, terminals, etc., many of which are included in this Manual.

(b) Standard specifications, instructions and requirements have been developed, the more important items of which are included in this Manual.

(c) In co-operation with the War Industries Board, certain restrictions have been imposed regarding the war-time use of materials; those readily obtained being substituted wherever practicable for those subject to shortage.

(d) General data and instructions are furnished for the guidance of field forces in the preparation of drawings for individual projects.

(e) The Engineering Division makes preliminary surveys and special investigations regarding the suitability of proposed sites, also regarding proposed new work or additions to existing structures.

(f) The number, type and sizes of buildings are determined and plot plans are made showing the most suitable locations.

(g) Estimates prepared by outside agencies are checked by this Division, and original estimates are furnished on requests properly authorized.

(h) Drawings and lists of materials are made for special structures on formal request, based on requirements furnished by the Bureau or Department concerned.

(i) Preliminary drawings and lists of materials are prepared in advance of actual authorization, when practicable, in order that the work of construction may begin without delay.

(j) Inasmuch as the Construction Division is responsible for all Army construction work, within the United States, the Engineering Division inspects and approves all drawings and specifications prepared by outside engineers and architects, and by other bureaus of the government, and lays down the fundamental data under which these drawings and specifications are to be made.

(k) This Division furnishes general consulting engineering service pertaining to unusual or difficult problems that arise during the progress of building operations.

(l) This Division is charged with the responsibility of providing complete records, showing the character, extent and details, of the executed project.

(m) This Division furnishes to other bureaus which may be involved, such preliminary information as may be available for their use. This includes approximate bills of material and other statistical information.

(n) This Division aids and advises, when requested, in negotiations of contracts for services; such as water supply, electric power, etc., etc.

ORGANIZATION.

The Engineering Division consists of a group of experts called advisory engineers, and includes a Supervising Architect, Advisory Architect, Expediting Engineers, drafting forces, estimators, special engineers, and field survey parties, under an administrative head known as the Officer in Charge. The activities of all these agencies are correlated by the Principal Engineer and his assistants, who constitute the executive force of the Engineering Division.

THE PRINCIPAL ENGINEER AND EXPEDITING OFFICER.

The function of the Principal Engineer is to correlate the activities of the various units that compose the Engineering Division, to furnish advisory Engineering service not otherwise provided for, and to act as general engineering executive.

One or more expediting engineers are assigned to the work pertaining to each of the six sections into which the Building Division is divided. These expediting engineers are the points of contact between the Engineering Division and the Building Division; on the one hand receiving the data from the Building Division or other sources, and on the other hand delivering plans, specifications, bills of materials and other data, to the various sections of the Building Division.

As soon as the requirements for any particular piece of work are sufficiently developed to warrant making estimates or starting the preparation of plans, the Building Division will call the expediting engineer into the case, if it is considered of sufficient magnitude or importance, or if the field forces are for any reason not in position to do the work properly. It is desirable that such information be obtained and furnished to the expediting engineers at as early a period as is practicable, in order that some considerable portion of the work may be ready for starting construction at the time of authorization.

The expediting engineer, having received the data and requirements, is then responsible for the development of the engineering work. It is generally found expedient at this stage to place the expediting engineer in touch with the representative of the client bureau, for the purpose of developing detail requirements. It is the duty of the expediting engineers to direct and co-ordinate the preparation of plans, to the end that all portions of the work will be completed as soon as practicable, and that no essential feature will be lacking. The expediting engineers will call upon the advisory engineers, the drafting forces and the field survey parties for such work as those agencies are responsible for, furnishing them with all available information. They will keep a record of the engineering history and progress of each job.

Upon the receipt of sufficient information the Expediting Officer will issue an advance information sheet, which serves to notify all concerned that this particular work is contemplated, and gives an approximate list of the principal materials, and other information required by the Requirements Division, War Industries Board, and other agencies of the Government.

Usually the first step in developing a project is to secure a survey. It is important to get this started quickly, as it takes time. The design of many of the utilities and the layout of buildings depend on the survey. The Engineering Division has equipment and men for survey work, but if it does not have sufficient force available, it may make arrangements with outside engineers for doing this work. Such outside service will generally be arranged for by conference between the Principal Engineer and the Section Chief concerned of the Building Division. Experience indicates the desirability of using the Engineering Division force whenever available.

Provided the requirements are sufficiently definite, plans for buildings usually can be started at the same time that the survey is started, although in many projects some features of certain buildings will be dependent on topography. The expediting engineer assigns the preparation of the building plans to the drafting forces and directs their development. As soon as the plans for the building construction have progressed far enough copies will be furnished to the advisory engineers for the design of the inside utilities. Nothing can be done on the lighting, heating, and plumbing of the buildings until the plans of the buildings themselves are determined.

Before beginning the preparation of plans for any building, the Expediting Engineer determines whether standard plans can be used. These can always be used for the construction of quarters for troops. Standard drawings are also available for a great many other structures. Such standard buildings as are useful in the project can at once be listed and schedules of building materials and inside utilities ordered.

The general location plan of the buildings having been determined and the survey received, the case is put into the hands of the Advisory Engineer on Camp Planning for the purpose of fitting the structures to the ground. In doing this he co-operates with the Advisory Engineer on Roads and Railroads, in order that advantage may be taken of the topography, both for the arrangement of the buildings and the laying out of roads and railroads.

The next step, after determining the layout of the buildings and grounds, is to provide for the outside utilities. Prints of the map, together with data regarding the buildings, are furnished to the Advisory Engineers on Water Supply, Sewerage and Electric Lighting for use in developing their parts of the project. The Expediting Engineer directs the development of the various steps of the project and furnishes data to the successive engineers interested, as quickly as the progress of the drawings will permit.

When requested to do so by the Building Division, the Expediting Engineer has estimates prepared by the Engineer on Estimating, with the total cost distributed among the various accounts.

In the case of plans prepared by outside engineers and architects and by other bureaus, the Principal Engineer will see that the plans are in conformity with Construction Division standards and requirements. If practicable, the Principal Engineer or some one especially assigned for the purpose, will keep in touch with the development of the plans so that they may be approved immediately upon completion.

The Principal Engineer will make special investigations relating to new projects of unusual character, or to engineering questions arising at the inception of the work or during the progress thereof. For these purposes, engineers familiar with the work and policies of the Construction Division are assigned.

ADVISORY ENGINEERS.

Following is a list of the advisory engineers, each of whom has a force of competent assistants:

Supervising Architect.
Advisory Architect.
Engineer in Charge of Surveys.
Advisory Engineer on Camp Planning.
Advisory Engineer on Roads and Railroads.
Advisory Engineer on Water Supply.
Advisory Engineers on Fire Protection.
Advisory Engineer on Sewerage and Sanitaon.
Advisory Engineer on Electric Power and Illumination.
Advisory Engineer on Plumbing and Heating.
Advisory Engineer on Refrigeration.
Advisory Engineer on Mechanical Equipment.
Engineer in Charge of Estimates.
Engineer in Charge of Schedules.
Engineer in Charge of Specifications.

It is the function of the advisory engineers to prepare drawings, estimates, reports, recommendations and, if necessary, schedules of materials. They also prepare standard drawings and specifications and general instructions to govern the work in the field. Detail drawings and schedules of materials will not be prepared when field engineers are available, except on request of the Building Division.

The special functions of the advisory engineers may be enumerated as follows:

SUPERVISING ARCHITECT.

The Supervising Architect is the medium through whom building requirements, furnished through the office of the Principal Engineer, are developed into working drawings. He is responsible for architectural design.

ADVISORY ARCHITECT.

The advisory architect's office will determine the size, character and arrangement of buildings to fit the needs of the various military units; will make recommendations regarding the necessity of proposed additional construction; and will pass on the location of additional structures in existing camps, cantonments and army posts. The location of such structures may be selected by the constructing officer, with the approval of the commanding officer, subject to certain restrictions and the principles set forth in this Manual.

ENGINEER IN CHARGE OF SURVEYS.

This office makes the survey of property which forms a basis for the definite layout of a project. For this purpose maps are provided. These maps may be made by others than employees of this office, but should conform to uniform standards, and for this reason surveys and maps made by, or under the direction of this office, are desirable. Maps show topography, existing roads, railroads, waterways and all other physical characteristics. Reports are made, in connection with surveys, covering all data not conveniently indicated on maps, such as geological characteristics, electric power, water supply, drainage, character of roads, land values, and character of outlying surroundings.

ADVISORY ENGINEER ON CAMP PLANNING.

The function of this office is to prepare typical layout plans and lists of buildings for the accommodation of army personnel in camps, cantonments and hospitals; and to develop final layout plans for each project, showing the location of buildings and other structures, as adapted to the actual topography and to existing main thoroughfares, railroads, drainage and other local

conditions. It is also the function of this office to prepare record plans for projects as actually built, and schedules of capacities actually provided in the plans. Consulting service is furnished on plans for housing and other military projects.

ADVISORY ENGINEER ON TRANSPORTATION.

The work of this office includes the design and layout of roads and pavements; also railroad tracks, turnouts, yards, trestles and coal storage facilities. Investigations and reports are made regarding the advisability and economy of installing industrial railroads for the transportation of camp supplies. Assistance is given to the Advisory Engineer on Camp Planning in the location of roads, railroads, coal trestles, warehouses and other buildings requiring transportation facilities.

ADVISORY ENGINEER ON WATER SUPPLY.

The work of this office includes the preparation of standard plans and specifications for water supply and water works construction; the securing of data on quality and quantity of available water supply, whether from underground or surface sources; reports on extensions to existing, privately or municipally owned, water systems, with a view to providing additional supply for Government activities from these systems; general layout plans of water distribution systems, including all necessary mains, valves, hydrants and connections, with especial reference to fire protection; and detail plans for piping and connections at important points, such as in the vicinity of pumping stations, wells, reservoirs, or the like. Lists of all water supply materials are furnished to the Engineer in Charge of Schedules. Consulting services are furnished to supervising constructing officers. This office also advises with municipal water departments and private water companies as to methods of conservation of water; with the Maintenance and Repair Section on replacements and extensions, methods of operation, and conservation of supply; with the Contract Section on matters relating to contracts for water supply or for water works construction; and with other departments, such as the Navy, Marine Corps, Housing Corporation and Shipping Board, on water supply problems of mutual interest.

ADVISORY ENGINEERS ON FIRE PROTECTION.

The functions of this office include the determination of the proper spacing of buildings with reference to material and fire hazard; location of fire-breaks, fire stops in walls and partitions; and materials and construction to be used under various circumstances of hazard. This office has charge of matters pertaining to fire-fighting appliances, fire stations, motor and hand-drawn fire apparatus, and the personnel for the equipment. This office has charge of the approval of plans for sprinkler systems, and arranges the provisions for them, and for fire alarm systems. The type and method of installation of heating and lighting apparatus, location of gasoline tanks and other fire risks, is subject to the approval of this office.

ADVISORY ENGINEER ON SEWERAGE AND SANITATION.

The work of this office includes the preparation of preliminary layouts of sewerage systems; consulting engineering services in connection with the installation and operation of sewage treatment and garbage incinerating plants; the preparation of detailed drawings and specificatiens for sewage pumping stations, sewage treatment plants, and surface and sub-soil drainage systems; the preparation of drawings for installation and operation of grease intercepting tanks for the reclamation of grease from kitchen waste liquids; and the preparation of detailed drawings and specifications for transfer stations for waste materials, garbage can washing equipment and gar-

bage incinerating plants. This office also, through the officer in charge of estimating, furnishes estimates of cost for construction under this heading. Schedules of materials, likewise, are furnished through the officer in charge of materials schedules.

ADVISORY ENGINEER ON ELECTRIC POWER AND ILLUMINATION.

The work of this office includes lighting and power installations for all projects; power houses and sub-stations; selection of special equipment, such as storage battery charging outfits and motor-operated cargo winches; advisory studies of engineering characteristics in the purchase of materials; consulting services relating to negotiations with central station companies, covering the purchases of electrical energy and the arangement of transmission lines and other facilities; the inspection of electric systems in plans; and studies of power facilities.

ADVISORY ENGINEER ON PLUMBING AND HEATING.

The work of this office includes steam-generating plants for heating, and steam requirements for general utilities; heating and ventilating systems, including the selection of heating stoves, hot-air and other furnaces, kitchen ranges, steam radiators and special equipment; plumbing inside of buildings, including hot and cold water supply; water filtration and sterilization plants; steam, hot and cold water and heating requirements for laundries; and the selection of kitchen and bakery equipment, including portable refrigerators. It furnishes consulting services in connection with the selection of special equipment and apparatus, negotiations for purchase of steam service, inspection of power, heating and ventilating systems, and studies of power facilities.

ADVISORY ENGINEER ON REFRIGERATION.

The work of this office includes cold storage and ice-making plants for the Army, both in the United States and overseas, freezer and refrigeration facilities, and the design and construction of ice-cooled refrigeration houses. Consulting services are furnished in connection with the selection of machinery, equipment, building and insulation materials. Studies and recommendations are made concerning existing ice-making and cold-storage facilities.

ADVISORY ENGINEER ON MECHANICAL EQUIPMENT.

The work of this office includes the selection and design of machinery and mechanical equipment for projects such as warehouses, industrial plants, power houses, etc. This work includes the selection and design of engines and boilers, coal and ash-handling machinery, stokers, power conveyors, elevators, locomotive gantry and jib cranes, and barge hoisting, freight hauling and weighing machinery.

ENGINEER IN CHARGE OF ESTIMATES.

This office prepares all estimates of cost, except such as may be made by the section engineers of the Building Division, or in the field, in which case they are checked through this office. Estimates are also prepared for the comparative cost of different types of construction. This office secures estimates of the cost of utilities and special equipment from the several advisory engineers, and incorporates them into the complete estimate for the job. Information regarding these requirements upon which estimates are based, are furnished to this office through the Principal Engineer.

ENGINEER IN CHARGE OF MATERIAL SCHEDULES.

This office, upon request of the expediting engineers, who furnish the necessary data, prepares schedules of materials required for the various projects. It issues such material schedules as may be prepared by the advisory engineers. These schedules are assembled and distributed to the proper officer of the Building Division.

ENGINEER IN CHARGE OF SPECIFICATIONS.

Emergency construction contracts are of such nature that elaborate specifications are unnecessary. Such as are provided are confined chiefly to notes on drawings, except in the case of some of the utilities.

Specifications are prepared under the direction of the Engineer in Charge of Specifications, for permanent construction, and wherever lump sum contracts are necessary.

SURVEYS AND MAPS

TOPOGRAPHIC SURVEYS.

It is essential that one or more base lines be established from which the required measurements are taken. The base lines should be located so as to command the best view of the area to be surveyed, the distance between the same to depend on the topography. On comparatively open level country the base lines should be as far apart as possible, depending on the accuracy required for the particular construction contemplated, while in rough wooded country, or where greater accuracy is required, they should be closer together. All points on base lines from which topography is taken, should be accurately located by means of transit and chain. Where more than one line is used they should form a closed traverse. In running the lines, the bearings of each course should be calculated and recorded, and the magnetic bearings taken as a check.

From points on the base line topographic features and required measurements are taken. For emergency operations the elevation of the ground, and the locations of topographic features, may be obtained by measuring horizontal and vertical angles, and computing distances from stadia rod readings. To avoid errors in reading or recording, all horizontal angles should read clockwise from 0 degrees to 360 degrees.

For operations where great accuracy is required, the survey is made using transit for lines, level and level rods for elevations, and chain for distances. This method is used in surveying built-up property, as in towns or cities, or in making surveys from which the detail plans for some particular structure are made.

The personnel of a topographic party consists of a Chief of Party, Recorder, Transitman, and as many rodmen, chainmen and axmen as can be used to advantage.

In locating land or property lines, all available data in deeds and maps, together with all property lines as indicated by fences, etc., and corners on the ground, should be used. The survey lines, wherever possible, should coincide with the property lines, and permanent corners should be marked by standard monuments.

HYDROGRAPHIC SURVEYS.

Relative elevations are obtained by taking soundings at points located by angles turned from a base line on the shore, and for this work two transits are required. Data as to the character of materials forming the bottom is obtained by wash borings, and the bearing power is determined from results obtained by driving test piles.

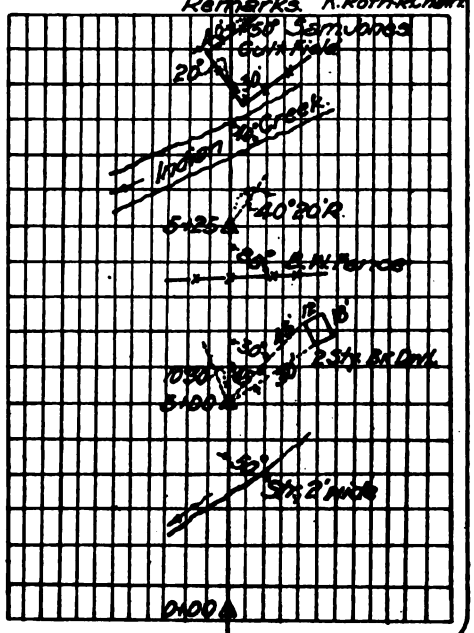
SECTION C. PLATE 1.

CONVENTIONAL TRANSIT NOTES

Station	Angle	B.S.	F.S.	Magnetic	Cal. Bear.
8+00					
+80					
7+00					
+20					
6					
5+25	▲40°20'R	3+00		N12°35E	N12°35E
5					
+25					
4					
3+00	▲10°30'L	0+00		N2°45W	N2°45W
2					
+40					
1					
0+00	"A" Prelim.			N11°15W	N11°15W

April 18, 1918. Clear - Cool. W. Smith - Notes. O. Jones - Inst. R. Clay - H. Chain. K. Roth - Rear Chain.

Remarks.



CONVENTIONAL LEVEL NOTES

Station	+ Sight	H.I.	- Sight	Rod	Elev.
B.M.	4.67	104.67			100.00
0+00 ▲				1.50	103.17
1				2.6	102.1
2				3.5	101.2
+20				5.0	99.7
3				3.0	101.7
4				7.0	97.7
T.P. +20	2.58	98.00	9.25		95.42
5				6.5	91.5
6				7.0	91.0
+40				5.0	93.0
T.P. 7+00			7.35		90.65

April 15, 1918. Clear - Windy. W. Nelson - Levels. R. Tape. - Rod.

Remarks

Crosson Granite Stone 10' to Pt. of Sta. 20 on "A" Line.

Bed Str. 2' wide " 1' deep

Center Pub. Rd.

T.P. Spike in W. Oak Tree 20' to Pt. of Line

CONSTRUCTION DIVISION OF THE ARMY

CONVENTIONAL SURVEY NOTES TOPOGRAPHICAL AND LAND SURVEYS

CONVENTIONAL STADIA TRAVERSE NOTES

April 20, 1918 Clear Cool — W. Smith-Notes, O. Jones-Inst., R. Clay-Rod, K. Roth-Rod

Station	Distance	Hor. Angle	Ver. Angle	Mag. Bear.	Cal. Bear.	Cor. Dist.	Diff. El.	Elev.	Remarks
"A"	"Occupied" = 132.45 (T.S. on 145)							107.13	H.I. = 5.2
145	445'	0°00'	0°00'	N34°45'W	N34°45'W	0.00	0.0	107.13	
"B"	540'	347°40'	-1°20'	N16°00'W	N16°05'W	-12.6	-90.1		
"B"	"Occupied" (T.S. on Sta. "A"								H.I. = 5.4
"A"	540'	0°00'	+1°20'	S16°00'E		+12.6			
"C"	380'	247°10'	-2°10'	N51°00'E	N51°05'E	-14.3	-75.0		

Note: All Angles shall be read to the Right. When possible use Zero Vertical Angle.

CONVENTIONAL STADIA TOPOGRAPHY NOTES

May 3, 1918 Clear Cool — W. Smith-Notes, O. Jones-Inst., R. Clay-Rod, K. Roth-Rod

Station	Distance	Hor. Angle	Ver. Angle	Cor. Dist.	Diff. El.	Elev.	Remarks
108+00						358.26	K.I. on Sta. 108.20 H.I. = 5.0'
		0°00'	-0°40'				
1	540'	347°40'	-1°20'		-12.6	345.6	Fence Corner
2	380'	331°40'	-2°10'		-14.3	344.0	
M.H.4	610'	112°12'	-4°00'		-41.4	346.7	
4	650'	35°11'	-0°20'		-3.8	352.4	
5	270'	295°45'	-2°40'		-12.6	343.8	Along Fence
M.H.8	610'	126°48'	-4°00'		-45.4	310.7	Fence Corner
7	500'	57°31'	-0°15'		-2.2	354.0	
M.H.8	445'	46°18'	+4°00'		+28.0	384.2	

Note: When possible use Zero Vertical Angle. H.I. = Height Instrument. M.H. = Middle Hair. When M.H. can not be set on H.I. reading, place on nearest Even Foot and record in Station Column. Correction for distance not made on Vertical Angle less than 5°

CONSTRUCTION DIVISION OF THE ARMY

CONVENTIONAL SURVEY NOTES

TOPOGRAPHICAL AND LAND SURVEYS

SECTION C. PLATE 3a.

Stream — NAME

Springs and Sinks

Lakes and Ponds — NAME

Falls and Rapids — NAME

Water Line

Marsh

Canals — NAME, Lock

Ditches — SIZE

CONSTRUCTION DIVISION OF THE ARMY
HYDROGRAPHY
RAILWAY TRACK MAPS

SECTION C. PLATE 3b.

Contour System

Sand

Cliffs

Steam Railways

Electric

Street

CONSTRUCTION DIVISION OF THE ARMY
RELIEF
RAILWAY TRACK MAPS

SECTION C. PLATE 3c.

Political Divisions, State, County or Township Lines. — Battle Twp. · Warren Co. Ohio; Posey Twp. · Adams Co. Ind.

Property Lines

Government Surveys, Base, Meridian, Township, Section or Harbor Line — Sec 18 T 8 N. R 11 E. 3rd P.M.; Sec 13, T 11 N. R 1 E. 3rd P.M.

Survey Lines — Final, Preliminary, Location

City

Village

City Limits

Fire Limits

Section Corner — 17 | 16 / 20 | 21

Section Center — 17, Quarter

Triangulation Station or Transit Point

Bench Mark — B.M. X 1232

Monuments — Stone □ ; Iron ■

CONSTRUCTION DIVISION OF THE ARMY
BOUNDARY AND SURVEY LINES
RAILWAY TRACK MAPS

SECTION C. PLATE 3d.

Stone — S

Frame — F

Brick — B

Concrete — C

Corrugated Iron — C.I.

Brick Passenger Station — B.P.

Electrical Sub-Station — E.S.

Lightning Arrestor House — L.A.

Platform or Driveway — Indicate Kind & Character

Ash Pit — A.P.

Coal Chute (Mechanical) — C.C.

Indicate Use and Number of Stories

CONSTRUCTION DIVISION OF THE ARMY
BUILDINGS
RAILWAY TRACK MAPS

SECTION C. PLATE 4a.

Railway Track

Old Track to be taken up

Proposed Tracks

Proposed (Future) Tracks

Foreign Tracks

Turnout and Switch Stand

Interlocked Switch

Double Slip Switch

Single Slip Switch

Derail

Bumping Post

CONSTRUCTION DIVISION OF THE ARMY
ROADWAY INDICATIONS
RAILWAY TRACK MAPS

SECTION C. PLATE 4b.

Mile Post

Section Post

Yard Limits

Highway Crossing Bell

Flangter Sign

Whistle Post

Crossing Sign

Tell-Tale

Boom Crane

CONSTRUCTION DIVISION OF THE ARMY
ROADWAY INDICATIONS
RAILWAY TRACK MAPS

SECTION C. PLATE 4c.

Cut

Embankment

Top of Slope

Bottom of Slope

Street, Block or Property Line

Center Lines

Company Property Line

Fence (on Street Line)

Fence (on Company Prop. Line)

Stone Fence

Board Fence

Picket Fence

CONSTRUCTION DIVISION OF THE ARMY
ROADWAY INDICATIONS
RAILWAY TRACK MAPS

SECTION C. PLATE 4d.

Barb Wire Fence

Rail Fence

Worm Fence

Woven Wire Fence

Snow Fence

Snow Shed

Turntable

Cattle Guard

Girder

Truss

Trestle

Signal Bridge

Lift Span

CONSTRUCTION DIVISION OF THE ARMY
ROADWAY INDICATIONS
RAILWAY TRACK MAPS

SECTION C. PLATE 5a

Public and Main Roads

Private and Secondary Roads

Trails

Street and Public Road Crossing

Private Road Crossing

Road Crossing at Grade

" " under "

" " overhead

Crossing Gate

Turnstile

Farm Gate

CONSTRUCTION DIVISION OF THE ARMY
HIGHWAYS AND CROSSINGS
RAILWAY TRACK MAPS

SECTION C. PLATE 5b

Bascule, Double Leaf

Bascule, Single Leaf

Draw Span

Water Column

Track Pan

Earth Ballast

Sand "

Cinder "

Slag "

Screenings "

Burnt Clay "

Chats "

Gravel "

CONSTRUCTION DIVISION OF THE ARMY
ROADWAY INDICATIONS
RAILWAY TRACK MAPS

SECTION C. PLATE 5c

Slag Ballast

Broken Stone Ballast

Pole Wire Lines

Rail Rest

Gantry Crane

Arc Lamp

Other Lamps

Railway Tunnel

Dimension Lines

Cribbing

Abutment, Wall and Pier

Track Scales

Wagon Scales

CONSTRUCTION DIVISION OF THE ARMY
ROADWAY INDICATIONS
RAILWAY TRACK MAPS

SECTION C. PLATE 5d

Mail Crane

True and Magnetic Meridian

Graphic Scales

Signal Tower

Traffic Direction

Signal Power Station

Signal Sub-Station

Coal Chute

Circular Engine House

Square Engine House

CONSTRUCTION DIVISION OF THE ARMY
ROADWAY INDICATIONS
RAILWAY TRACK MAPS

In order that field notes may be readily platted, a form of notes as nearly standard as is consistent should be used. Specimens of conventional forms of notes are shown on Plates 1 and 2. For the details and routine of all ordinary work, the methods described in generally accepted hand-books for engineers are used.

REPORTS.

All maps should be accompanied by reports which should include all pertinent information relative to electrical power, water supply, sewers, roads, railroads which may serve the project, and all towns or cities within or contiguous to the area surveyed. Reports should also include data as to the geology of the area surveyed, value of lands, and all other data which cannot be shown on maps.

MAPS.

Maps made from surveys are ordinarily platted on a scale of 1 inch to 100 feet. This scale will ordinarily allow sufficient detail, although for more important structures, or where greater detail is required, a larger scale is desirable. Smaller scale maps are of value in that they convey general ideas of larger projects. The contour interval is one foot, two feet, five feet, ten feet, depending on the character of the ground, or improvements to be made.

In making maps to be used for developing building layouts, railroads, etc., topographical features should be drawn on the back of the tracing, leaving the other side to show proposed work. Convention symbols, shown on Plates 3 to 6, inclusive, are used on all topographic and railroad maps.

CAMP PLANNING

The Camp Planning Section of the Engineering Division has been established to prepare plans for the layout of grounds and list of buildings for camps, cantonments, and hospitals, intended for the use of Army personnel. The Advisory Engineer on Camp Planning may be called upon for consultation in connection with war emergency housing projects and the development of quarters for all military establishments.

In camp planning, three distinct problems are involved. First, the selection of sites and the determination of the character, number, size and groupings of buildings desired, roads, yards, open spaces, and other features required for the project; second, the preparation of typical plans showing proposed development subject to later modifications; and third, the preparation of plans for actual construction, adapted to meet the lines of approach and transportation, drainage conditions, and the topography of the site.

The locations of the first 32 camps were selected by the commanders of the six territorial departments of the United States, in accordance with instructions set forth in memorandum of May 4, 1917, prepared by the War College, and issued to them May 10th. This memorandum read as follows:

"The department commanders should be guided in their selections, and boards of officers in their investigations and recommendations, by the following general rules:

"(1) Property owned or leased by the United States and controlled by the War Department should be utilized wherever suitable and available.

"(2) Whenever practicable troops should be grouped by divisions; therefore, sites should be selected which will accommodate a complete division.

"(3) In case it is impracticable to secure divisional sites, effort should be made to select sites for brigades or larger parts of a division, so located with respect to one another as to facilitate supply from one central point and the administration and the supervision and co-ordination of the training of the division from its headquarters. This object will have been attained when no two camp sites of units of any division are more than 15 miles apart.

"(4) Sites for commands smaller than a brigade will not be selected unless it is impracticable to secure brigade camp sites.

"(5) It is impracticable to specify the amount of terrain that will be required for the training of commands of the various sizes. Local conditions and the differences in terrain will have to be considered in each case by the department commanders and the boards concerned. It is essential, however, that each camp site—

(a) Be of sufficient size to accommodate the command without crowding.

(b) Have an adequate water supply for both the men and animals to be encamped thereon.

(c) Contain within itself, or be located within convenient distance of an adequate training area.

(d) Contain within itself, or be located within convenient distance of suitable ground for target practice.

(e) Be located upon or near a railroad of sufficient capacity to insure the convenient supply of the command and its prompt movement in case of need.

(f) Can be leased (if not already owned or leased by the government) for one or two years, with the option of renewal from year to year for about five years.

(g) Be immune from floods and inundations.

"(6) The following very desirable features should be secured whenever practicable:

(a) The soil should be sandy loam with good drainage.

(b) The surroundings should be healthful.

(c) An "A" and a "B" range within convenient distance.

(d) An artillery range within convenient distance.

(e) The site should afford natural bathing facilities, such as streams, lakes or the sea.

(f) The site should be adjacent to a city or large town containing facilities for healthful and attractive recreation.

"(7) The following desirable features are not so important as those enumerated under (6), but they should not be overlooked as they tend toward efficiency, economy and the welfare and contentment of the command:

(a) Roads, good or potentially good.

(b) Infrequent interruptions to training by inclement weather.

(c) Grazing for animals within convenient distance.

(d) Absence of insect pests.

(e) Good strategical location.

(f) Location central with respect to training area.

(g) Material for temporary shelter locally obtainable in sufficient quantities at reasonable prices.

(h) Mechanical, skilled and common labor locally obtainable at reasonable wages.

(i) Site and training areas donated or offered at low rental.

(j) Good markets at reasonable prices.

(k) Adequate local control of social evil and the liquor traffic.

(l) Adequate local regulations of monopolies and price-discrimination."

The Construction division has had direct connection with the selection of many of the sites for camps built since the 32 original camps were chosen.

Since, in most cases, emergency camps must be built before general layout plans for actual areas can be prepared, typical plans for each unit and for each camp as a whole, have been designed and used as a guide and measure for the development of actual plans for starting the work. These typical plans, the latest of which are listed on page 12 and some of which are illustrated in this Manual, Plates 10 through 18, are based on schedules of personnel, showing the total number and character of units to be accommodated, and for each unit the number of persons, animals and vehicles, as determined after consultation with the various authorities interested. These schedules form a definite skeleton organization, which simplifies greatly the problems of detailed planning. The plans have been completed to show typical arrangements for water and sewer systems, roads, and other utilities.

Based on the schedules of personnel, a list of buildings and other structures required for the accommodation of each unit has been prepared, together with a complete schedule of general features, such as warehouses, railroads, yards, laundry, utilities buildings, construction buildings, post-office, library, hospitals, remount station and rifle ranges necessary for the camp as a whole.

The unit of camp personnel has been based on the 250 man company to be housed in four two-story 66 man barracks with separate mess and lavatory buildings. For the proposed grouping and spacing of buildings for each unit and in order to simplify the grouping or interchanging of units, a standard area has been adopted, based primarily on a town block about 450 feet by 800 feet, with streets on four sides. In this block, 8 companies of 250 men can be accommodated. Outside of the block at one end, space is reserved for officers, and outside of the block at the other end, space is reserved for animals and vehicles. By the repetition of blocks indefinite expansion is possible, and where located in open areas, indefinite increase at each block is also possible for officers and administration at one end and for animals and vehicles at the other.

By the adoption of one or more of these blocks for each tpyical military unit, it has been possible to lay out a sufficient number of blocks for a camp and to determine in advance all general features as to water, sewer, roads, and location of buildings, so that work can be begun at once before local details have been determined. By this means, both the area required and a practical method of using land selected for construction purposes has been established in a very short time.

In addition to the typical plans for each unit, typical general layout plans to show possible grouping of units and of all general buildings and utilities have been prepared for the sites where actual surveys have not been at once available. (See plate 10.) These layout plans serve as a basis for estimates of cost, and also as a measure for the selection of areas required. On the typical layout plan the ideal grouping of units and the most desirable relation of units to lines of approach, general utilities, and other features of the plan are indicated as far as possible. In the grouping of units, space is left at frequent intervals for fire protection, on a general basis that where two rows of units are built there shall be not less than 500 feet distance, preferably 1,000 feet, between the nearest structures of the two rows, and that in each row of units there shall be not more than two blocks, nor more than 4,000 or 5,000 persons in one group, separated from the nearest buildings of the next group by not less than 300 feet. The need for these open spaces, primarily for fire protection among wooden buildings where a large number of lives are involved, has been accepted as a minimum measure for public open space to be provided within the camp, whereas various other uses for exercise and drill purposes have proved ample justification for reservation of such areas in addition to the needs for fire protection.

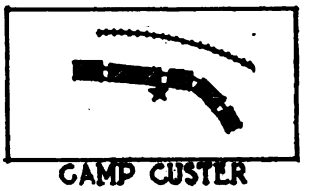
In preparation of plans for the large cantonments, special Camp Planning Engineers were employed in the field, to take the typical plans and general instructions from Washington and to develop actual working plans to meet conditions found in the field. As soon as possible after sites were selected and the work was started, general plans, based on actual surveys and adapted to local conditions such as main thoroughfares, railroads, drainage and other topographical features, were prepared which determined the controlling features of each project. Copies of such general plans for Camp McClellan, a tent camp; and Camp Dix, a cantonment, are shown on Plates 7 and 8.

LATEST TYPICAL PLANS FOR CANTONMENT GROUNDS.

	Job No.	Plan No.
Typical plan for complete cantonment	610	240
" Division headquarters	"	221
" Regt. of Infantry Brigade H'dq't'rs and Inf. M. G. B.	"	222
Machine Gun Batt'n (Division) 2 Co.'s motorized	"	223
Typical Field Signal Battalion	"	224
" Regiment of Light Artillery	"	225
" Regiment of Heavy Artillery	"	226
" Train Headquarters and Military Police	"	227
" Ammunition Train and Mobile Ordnance Repair Shop	"	228
" Supply Train	"	229
" Sanitary Train	"	230
" Regiment of Engineers and Engineers' Train	"	231
" Plan for Camp Center	"	232
" Plan for Depot Brigade and Depot Brigade Headquarters	"	233
" Typical Plan for Barracks in two (2) training battalions	"	235
" Layout for railroad terminal	"	238
" Regt. of Heavy Artillery (to be housed in tents)	"	266
" Regt. of Light Artillery (to be housed in tents)	"	267
" (Special) Regt. of Heavy Art. & Art. Brigade Headquarters	"	268
" (Special) Regt. of Light Art. & Art. Brigade Headquarters	"	269
" Ammunition Train and Mobile Ordnance Repair Shop	"	272
" Plan for Quarantine Camp for 1,000 men	"	274
" Plan for Detention Camp for 3,000 men	"	275
" Artillery Park	"	276
" Labor Battalion	"	277
" Layout for Air Service Training Brigade (to be housed in tents)	"	278
Special Plan for Two Balloon Co.'s and one Aero Squadron	"	281
Typical Ammunition Train and Mobile Ordnance Repair Shop (in tents)	"	283
Depot Brigade and Depot Brigade Headquarters (to be housed in tents)	"	288
Typical Plan for Depot Brigade with Latrine and Bath Houses (in tents)	"	291
Special Plan for one Balloon Co. and one Aero Squadron (in tents)	"	297
Special Plan for Artillery Park (to be housed n tents)	"	298
Typical Plan for Labor Battalion (to be housed in tents)	"	299
Special Layout for Regt. of Engineers' Train	"	301
Typical Plan for Officers' Training School	634	106
Remount Station for 7,500 animals	404	48
Rifle Range—Ground Plan for A-4 Targets	416	7
Rifle Range—Ground Plan for 6" x 6" Sliding Targets	416	8
Rifle Range—Ground Plan for 6" x 10" Sliding Targets	416	9
Machine Gun Range—Ground Plan for Machine Gun Targets	416	10
Typical Arrangement of Rifle and Machine Gun Target Ranges	416	18
Typical Plan for Hospital Layout	632	500

GENERAL MAP
CAMP McCLELLAN, ALA.
NORTH
BASE HOSPITAL
2
5
7

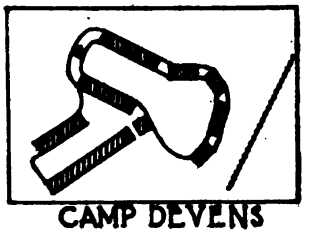
CAMP DIX, N.J.
KEY MAP
WRIGHTSTOWN



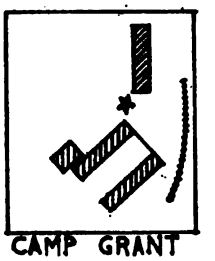
CAMP CUSTER

CAMP GORDON

CAMP PIKE

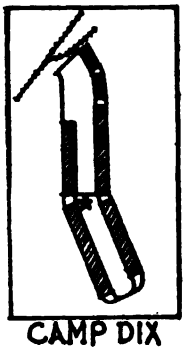


CAMP DEVENS



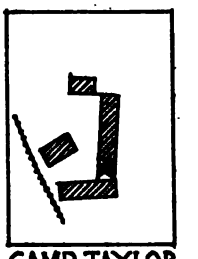
CAMP GRANT

CAMP SHERMAN

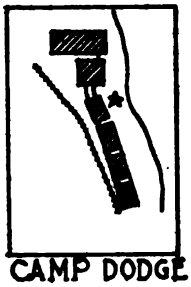


CAMP DIX

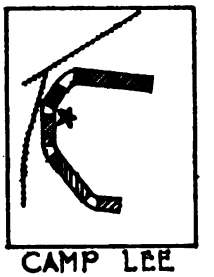
CAMP JACKSON



CAMP TAYLOR

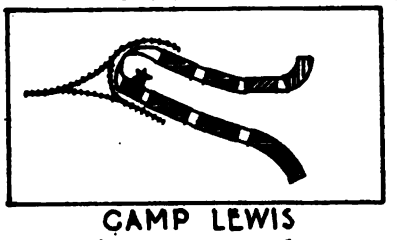


CAMP DODGE

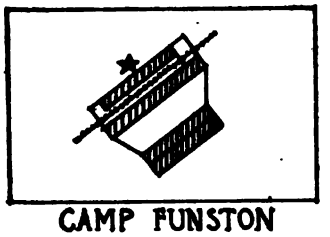


CAMP LEE

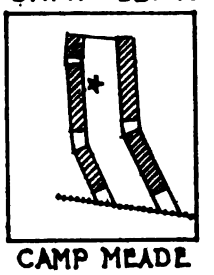
CAMP TRAVIS



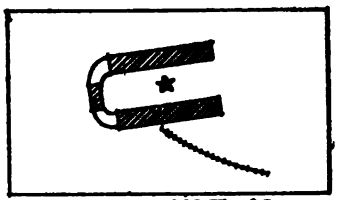
CAMP LEWIS



CAMP FUNSTON



CAMP MEADE

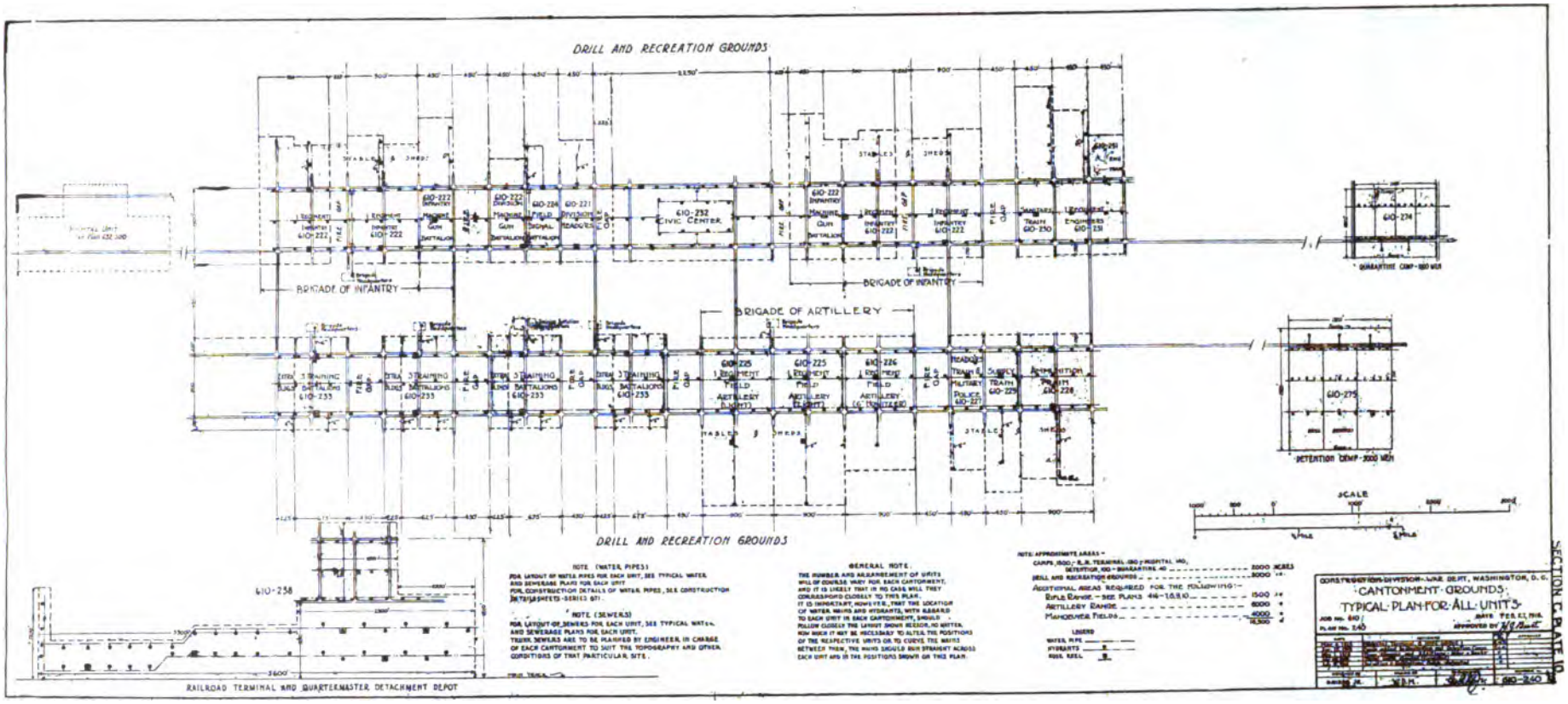


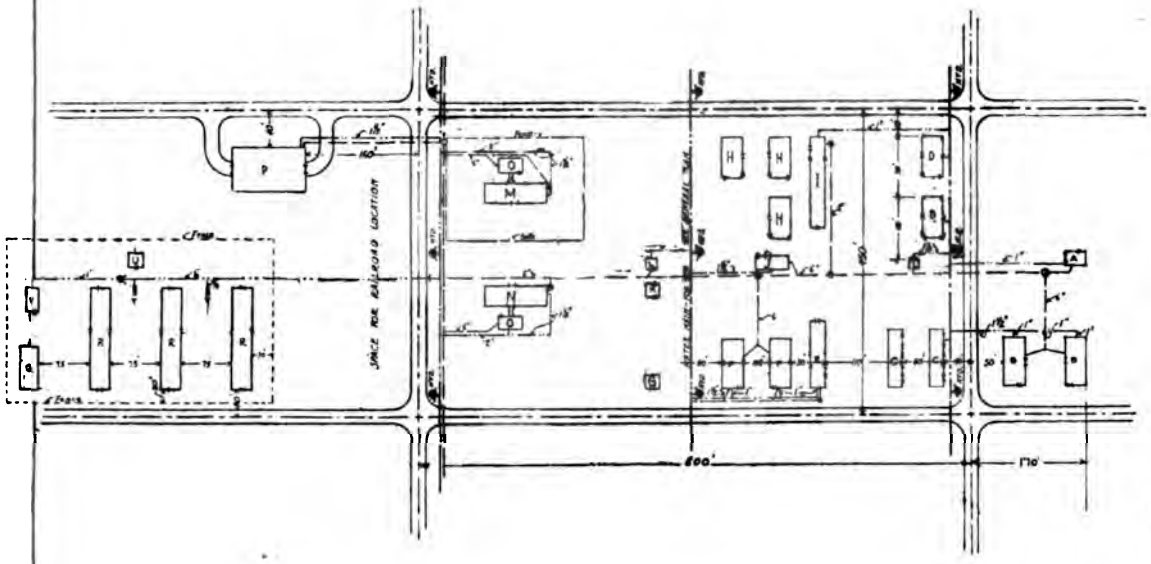
CAMP UPTON

(APPROXIMATELY TYPICAL LAYOUT)

CONSTRUCTION DIVISION OF THE ARMY

BLOCK PLANS OF N. A. CANTONMENTS


DRILL AND RECREATION GROUNDS
610-232 CIVIC CENTER
BRIGADE OF INFANTRY
BRIGADE OF INFANTRY
BRIGADE OF ARTILLERY
610-274
610-275
DRILL AND RECREATION GROUNDS
610-238
RAILROAD TERMINAL AND QUARTERMASTER DETACHMENT DEPOT
SCALE
NOTE (WATER PIPES)
NOTE (SEWERS)
GENERAL NOTE.
CONSTRUCTION DIVISION - WAR DEPT, WASHINGTON, D. C.
CANTONMENT GROUNDS
TYPICAL PLAN FOR ALL UNITS
SECTION C PLATE 10



SCHEDULE OF BUILDINGS

Key Letter	Type of Building	Size	Cost Nº 620 Plan Nº
A	COMMANDING OFFICERS QUARTERS	20'X28'	344
B	OFFICERS QUARTERS	30'X70'	343
C	ADMINISTRATION BLDG	20'X64'	327
D	PSYCHOLOGICAL BLDG	23'-6"X60'	315,314
E	OFFICERS MESS HALL	20'X38'	316
F	VISITING OFFICERS QUARTERS	30'X70'	345
G	CIVILIANS BARRACK (Not Shown)	20'X21'	369 (TYPE A)
H	BARRACK	23'-6"X60'	313, 314
I	MESS HALL	20'X133'	316
J	LAVATORY	20'X49'	345
K	WAITERS BARRACK	20'X21'	333
L	" " LAVATORY	14'X14'	348
M	PRISONERS BARRACK	23'-6"X90'	373
N	GUARDS BARRACK A	23'-6"X90'	373A
O	" " " LAVATORY	20'X35'	347
P	GARAGE	65'X106'	322
Q	WAGON SHED	89'X45'	332
R	STABLE	29'X130'	421
T	WATERING TROUGH	2'-6"X 10'	413
U	STABLE GUARD	16' X 21'	395
V	SHOP	20' X 36'	378

DETAIL PLANS

CONSTRUCTION DETAILS	620-345,97
STOVES & RANGES	" - 345,350
HOT WATER HEATING "	" - 351
ELECTRICAL SPECIFICATIONS	" - 367
LAVATORY DETAILS	" - 369
SINK DETAILS	" - 372
FENCE "	" - 384

NOTE:- ALL LATERAL SEWER PIPES TO BE 6" UNLESS OTHERWISE LABELLED

NOTE ALL SERVICE PIPES TERMINATE 5 FEET FROM BUILDINGS

WATER
SEWER
MANHOLE
HYDRANT
HOSE REEL
GREASE TRAP

SCALE

CONSTRUCTION DIVISION WAR DEPT WASHINGTON, D. C.

CANTONMENT GROUNDS

TYPICAL DIVISION HEADQUARTERS

JOB No. 610

PLAN No. 221

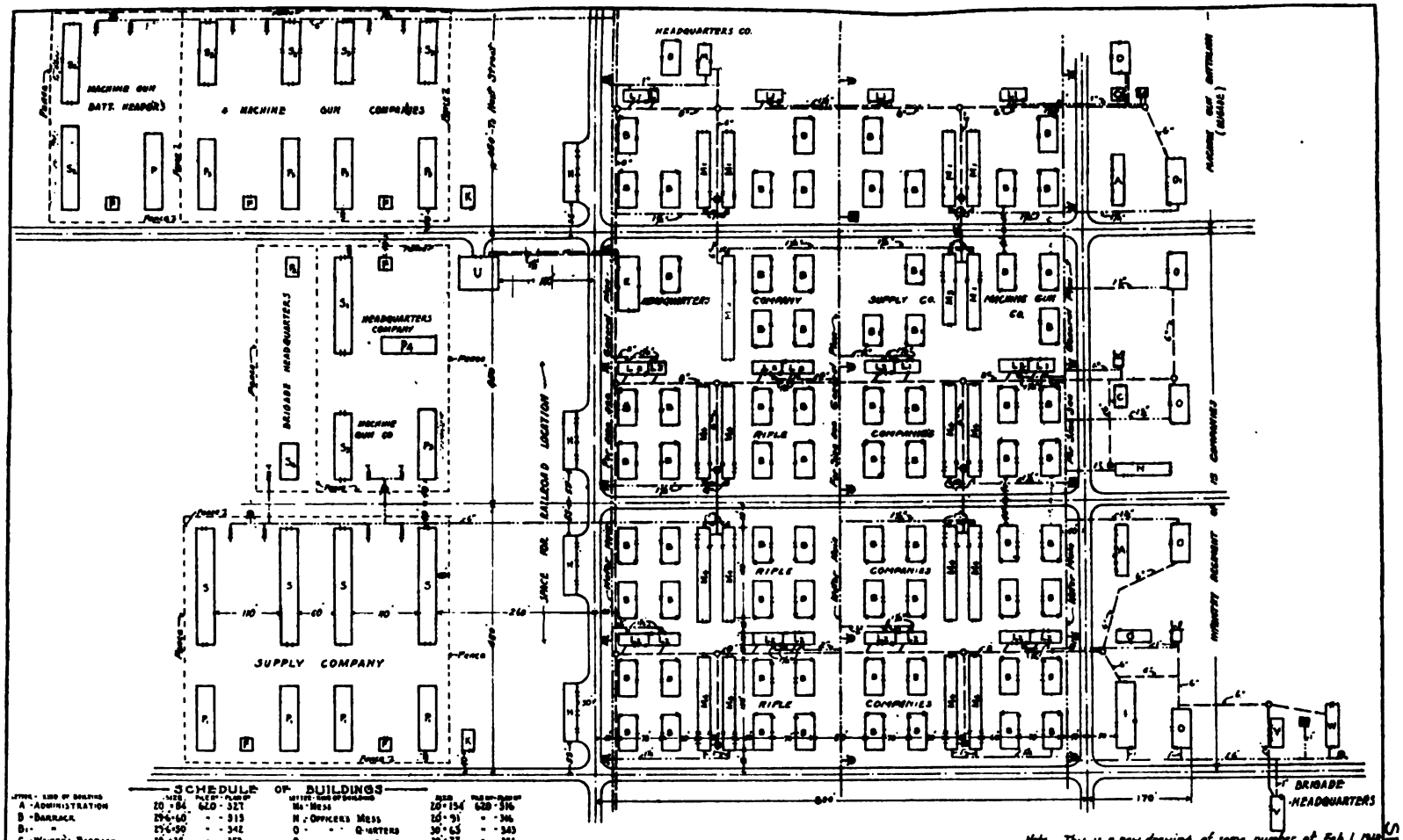
DATE FEB 1, 1918

APPROVED BY H. J. Burt

DATE	REVISIONS	BY	APPROVED
FEB 14 1918	CORRECTIONS MADE, Water + Sewer added	E.L.K.	
JULY 24 1918	11 Quarters Partially altered, Water + Sewer Service added to Prisoners Barracks	E.L.K.	
SEPT 16 1918	Kitchen Quarters changed to Officers Quarters	E.L.K.	

DESIGNED BY — DRAWN BY E.L.K. — CHECKED BY — NUMBER 610-221

SECTION C. PLATE 11



SCHEDULE OF BUILDINGS

LETTER - KIND OF BUILDING	SIZE	PAGE OF PLAN OF
A - Administration	20 × 84	620 - 327
B - Barrack	23'-6" × 60	" - 313
B1 - "	23'-6" × 50	" - 342
C - Waiters Barrack	20 × 35	" - 353
C1 - " - "	20 × 21	" - 353
D - Medical Building	36' × 36	" - 449
E - Post Exchange	32' × 91	" - 367-398
F - Stable Guard	20 × 21	" - 395
G - Guard House	20 × 36	" - 339
H - Store House	20 × 98	" - 348
I - Medical Building	23'-6"-11"-10"	" - 383
K - Shop	20 × 36	" - 372
L - Lavatory	16 × 20	" - 349
L1 - "	20 × 42	" - 346
L2 - "	20 × 49	" - 345
L3 - "	20 × 28	" - 348
L4 - Waiters Lavatory	16 × 16	" - 345
L5 - Guard House Lavatory	16 × 20	" - 349
M - Mess	20' × 96	" - 316
M1 - "	20 × 126	" - 316
M2 - "	20 × 173	" - 316
M3 - "	20 × 119	" - 316

LETTER - KIND OF BUILDING	SIZE	PAGE OF PLAN OF
M4 - Mess	20 × 154	620 - 316
N - Officers Mess	25' - 91	" - 346
O - " - Quarters	30' × 65	" - 343
O1 - " - "	30' × 77	" - 344
P - Wooden Shed	25' × 126	" - 388
P1 - " - "	25' × 106	" - 388
P2 - " - "	25' - 36'	" - 332
P3 - " - "	25' × 101'	" - 338
P4 - " - "	25' - 90'	" - 332
S - Stable	25' × 198'	" - 421
S1 - "	25' × 168'	" - 422
S2 - "	25' × 140'	" - 421
S3 - "	25' × 112'	" - 421
S4 - "	25' × 68'	" - 421
T - Watering Trough	26' × 10'	" - 423
U - Garage	54' × 65'	" - 322
BRIGADE HEADQRTRS.		
V - Officers Quarters	26' × 55	" - 337
W - Detachment Barrack	26' × 10	" - 359 Type B
X - Lavatory	14' × 16	" - 349
Y - Administration	26' × 99	" - 356

NOTE - ALL LATERAL SEWER PIPES TO BE 6" UNLESS OTHERWISE LABELED

NOTE ALL SERVICE PIPES TERMINATE 5 FT FROM BUILDING

WATER SHOWN THUS ——— SEWER - - - MANHOLE ——○—— HYDRANT ——▲—— HOSE REEL ——▣—— GREASE TRAP ——●——

Note - This is a new drawing of some number of Feb. 1, 1918.

SCALE

CONSTRUCTION DIVISION WAR DEPT. - WASHINGTON, D. C.

CANTONMENT GROUNDS

TYPICAL REGT OF INFANTRY, BRIGADE HDQRTRS &

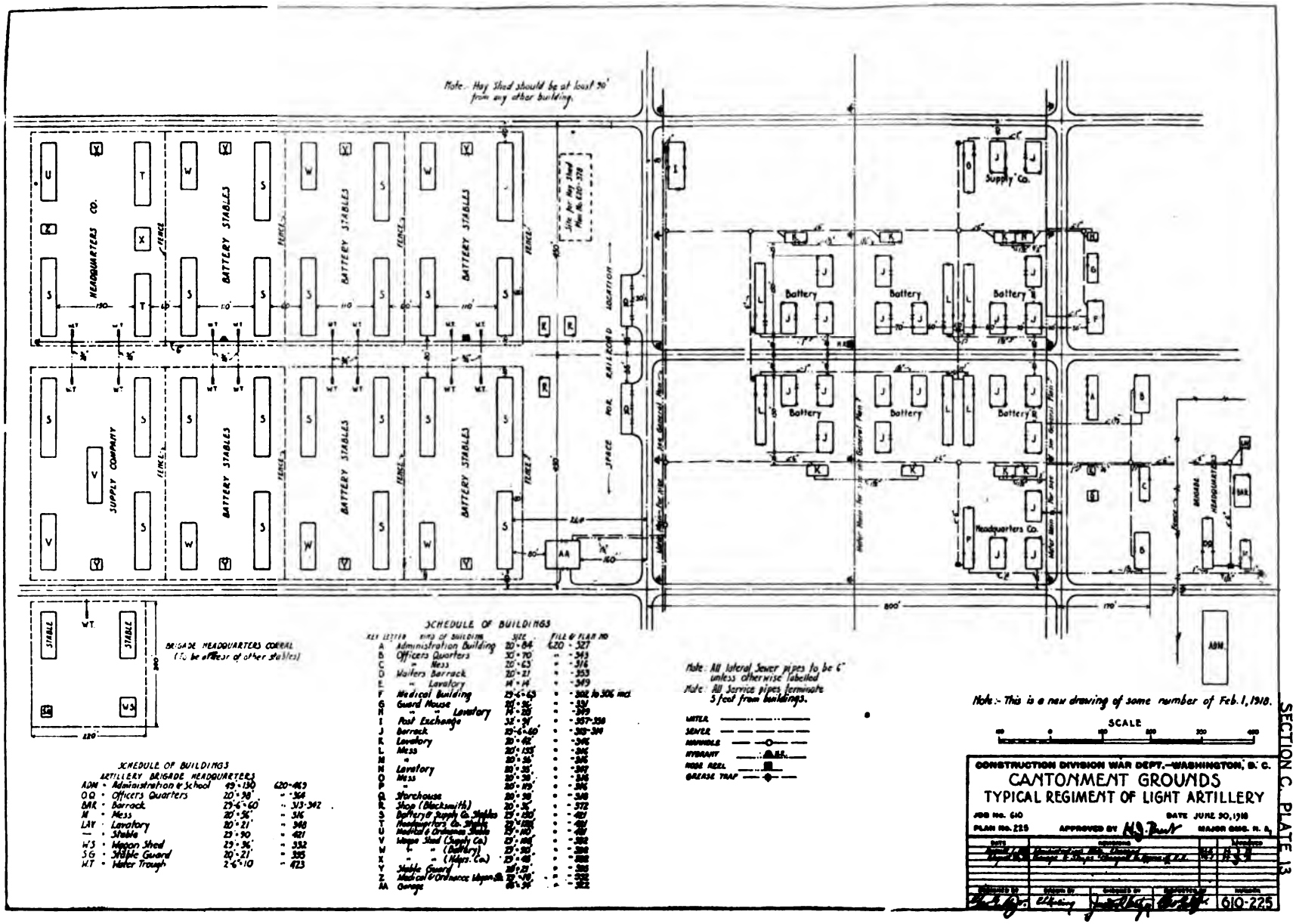
JOB NO 610 INFANTRY MACH GUN BATT. DATE JUNE 30, 1918

PLAN NO 222 APPROVED BY H. J. Brent MAJOR CONS. C. A.

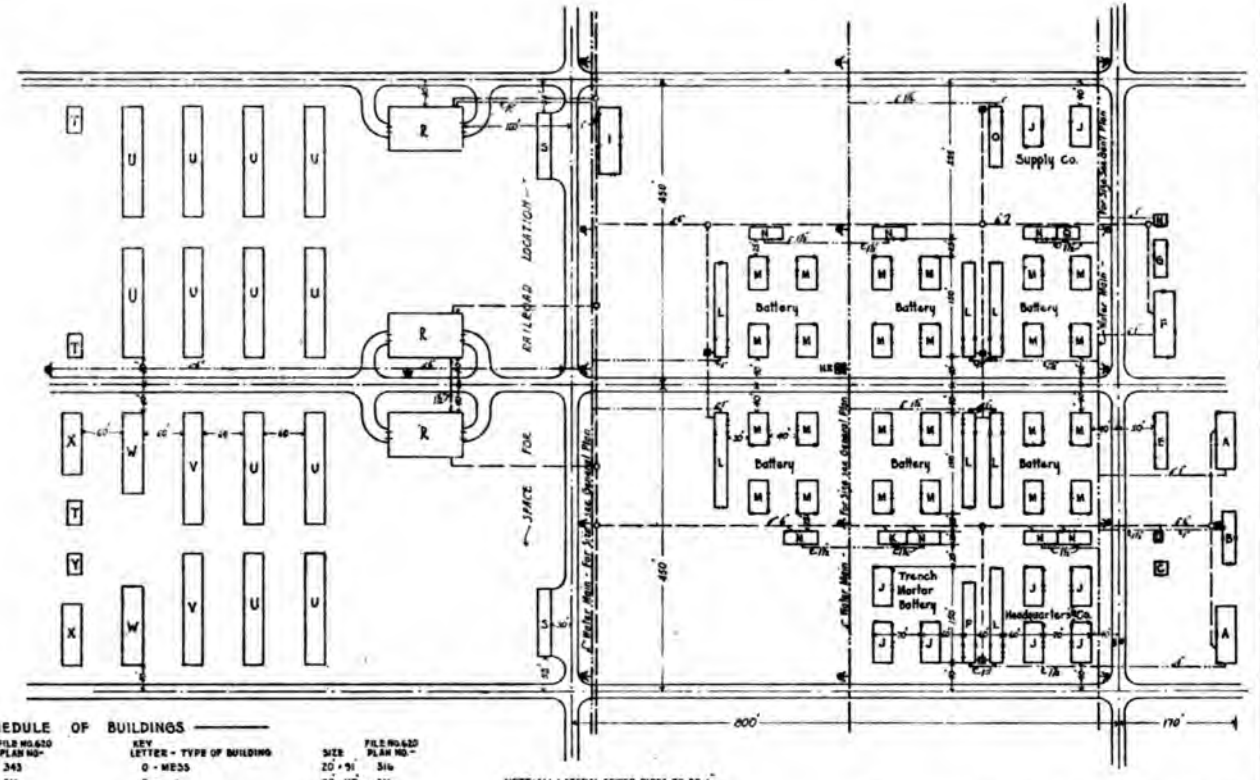
DATE	REVISIONS	BY	APPROVED
May 31, 1918	Garage changed		

DESIGNED BY ... DRAWN BY ... CHECKED BY ... SUPERVISED BY ... 610 - 222

SECTION C. PLATE 12


Note:- Hay Shed should be at least 50' from any other building.
HEADQUARTERS CO.
BATTERY STABLES
SUPPLY COMPANY
Supply Co.
Battery
Headquarters Co.
SPACE FOR RAILROAD LOCATION
Site for Hay Shed Plan No 620-328
STABLE
W.T.
BRIGADE HEADQUARTERS CORRAL (To be at rear of other stables)
SCHEDULE OF BUILDINGS
ARTILLERY BRIGADE HEADQUARTERS
ADM - Administration & School 49'-150' 620-469
OQ - Officers Quarters 20'-98' - 364
BAR - Barrack 29'-6"-60' - 313-342
M - Mess 20'-56' - 316
LAV - Lavatory 10'-21' - 348
— - Stable 29'-90' - 421
WS - Wagon Shed 29'-96' - 332
SG - Stable Guard 20'-21' - 395
WT - Water Trough 2'-6"-10' - 423
SCHEDULE OF BUILDINGS
KEY LETTER KIND OF BUILDING SIZE FILE & PLAN NO
A Administration Building 20'-84' 620 - 327
B Officers Quarters 20'-70' " - 343
C " Mess 20'-63' " - 316
D Waiters Barrack 20'-21' " - 353
E " Lavatory 14'-14' " - 349
F Medical Building 29'-6"-63' " - 302 to 306 incl.
G Guard House 20'-25' " - 314
H " Lavatory 14'-20' " - 349
I Post Exchange 32'-24' " - 357-358
J Barrack 29'-6"-60' " - 313-342
K Lavatory 20'-42' " - 348
L Mess 20'-133' " - 316
M " 20'-36' " - 316
N Lavatory 10'-20' " - 348
O Mess 20'-98' " - 316
P " 20'-49' " - 316
Q Storehouse 20'-38' " - 318
R Shop (Blacksmith) 20'-34' " - 372
S Battery & Supply Co. Stables 29'-6"-120' " - 421
T Headquarters Co. Stables 29'-6"-90' " - 421
U Medical & Ordnance Stables 29'-6"-90' " - 421
V Wagon Shed (Supply Co.) 29'-96' " - 332
W " " (Battery) 29'-96' " - 332
X " " (Hdqrs. Co.) 29'-96' " - 332
Y Stable Guard 20'-21' " - 395
Z Medical & Ordnance Wagon Sh. 29'-96' " - 332
AA Garage 20'-34' " - 372
Note: All lateral Sewer pipes to be 6" unless otherwise labelled
Note: All Service pipes terminate 5 feet from buildings.
WATER
SEWER
MANHOLE
HYDRANT
HOSE REEL
GREASE TRAP
Note:- This is a new drawing of some number of Feb. 1, 1918.
SCALE
CONSTRUCTION DIVISION WAR DEPT.-WASHINGTON, D. C.
CANTONMENT GROUNDS
TYPICAL REGIMENT OF LIGHT ARTILLERY
JOB No. 610
DATE JUNE 30, 1918
PLAN No. 225
APPROVED BY H.J. Brent
MAJOR QMC. N. A.
610-225

SECTION C. PLATE 13.



SCHEDULE OF BUILDINGS

KEY LETTER - TYPE OF BUILDING	SIZE	FILE NO.620 PLAN NO-
A - OFFICERS QUARTERS	30 · 84	343
B - " MESS	20 · 77	316
C - WAITERS BARRACK	20 · 41	353
D - " LAVATORY	14 · 14	349
E - ADMINISTRATION BLDG	20 · 84	327
F - MEDICAL BUILDING	25-6 · 97-6	392 · 393
G - GUARD HOUSE	20 · 36	351
H - " " LAVATORY	14 · 20	349
I - POST EXCHANGE	32 · 91	357 · 358
J - BARRACK	25-6 · 40	313 · 314
K - LAVATORY	20 · 42	346
L - MESS	20 · 140	316
M - BARRACK	25-6 · 50	342 · 344
N - LAVATORY	20 · 45	345

KEY LETTER - TYPE OF BUILDING	SIZE	FILE NO.620 PLAN NO-
O - MESS	20 · 91	316
P - "	20 · 119	316
Q - LAVATORY	20 · 35	347
R - GARAGE	65 · 106	322
S - STOREHOUSE	20 · 98	318
T - SHOP (BLACKSMITH)	20 · 36	372
U - WAGON SHED (BATTERY)	29 · 162	332
V - " " (SUPPLY)	29 · 162	332
W - " " (TRENCH MOR BAT)	29 · 117	332
X - " " (HEADQRS CO)	29 · 90	332
Y - " " (MED&ORD)	29 · 115	332

NOTE: ALL LATERAL SEWER PIPES TO BE 6" UNLESS OTHERWISE LABELLED.
NOTE: ALL SERVICE PIPES TERMINATE 5 FEET FROM BUILDINGS.

WATER:
SEWER:
MANHOLE:
HYDRANT:
HOSE REEL: H.R.
GREASE TRAP:

Note:- This is a new drawing of same number of Feb. 1, 1918.

SCALE 100 0 100 200 300 400

CONSTRUCTION DIVISION WAR DEPT. WASHINGTON, D. C.

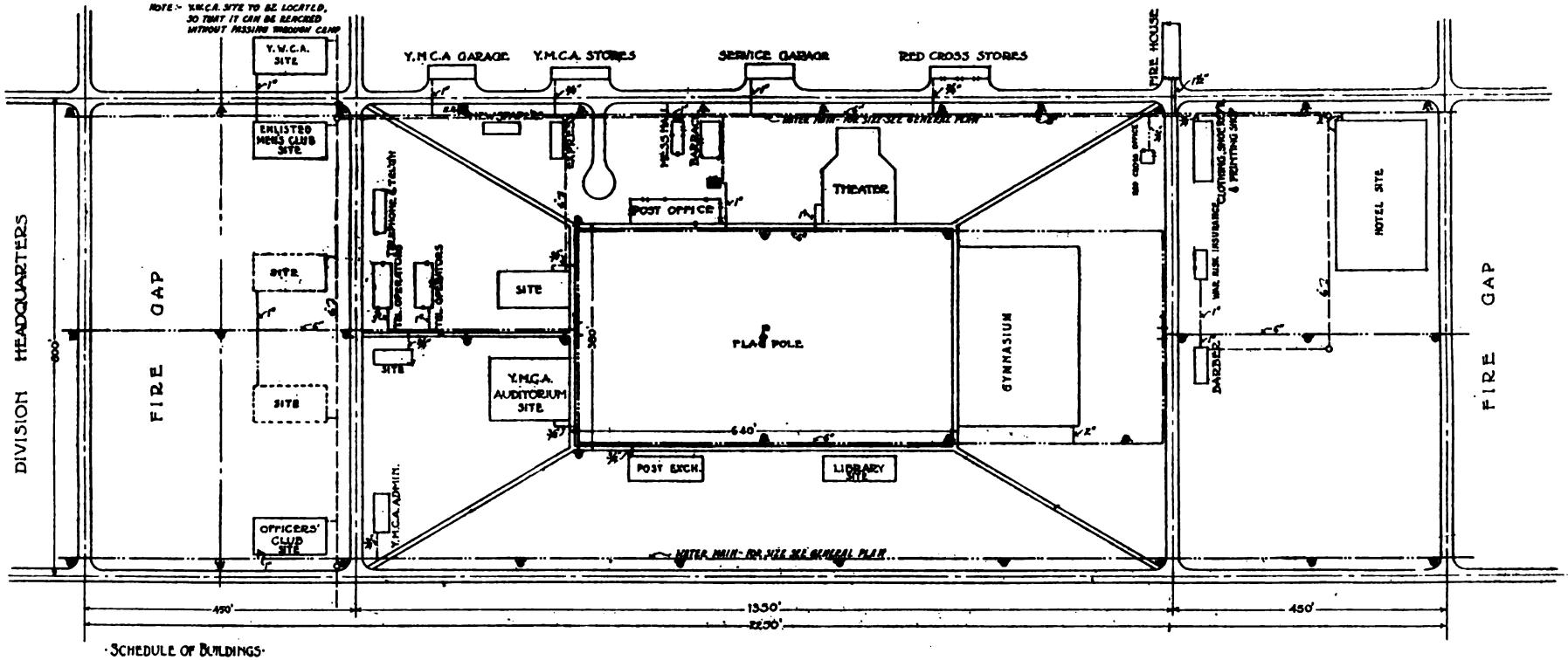
CANTONMENT GROUNDS
TYPICAL REGIMENT OF HEAVY ARTILLERY

JOB No. 610 DATE JULY 6 · 1918
PLAN No. 226 APPROVED BY H. J. Burt MAJOR QMC. N. A.

DATE	REVISIONS	BY	APPROVED
Aug 29 1918	Water revised and Location noted		H.J.B.

DESIGNED BY GGIBBS JR | DRAWN BY JEFFERS | CHECKED BY | INSPECTED BY | NUMBER 610-226

SECTION C. PLATE 14



SCHEDULE OF BUILDINGS

KIND OF BUILDING		SIZE	PLAN NO.
RED CROSS	OFFICE	20'×21'	648-349 TYPE B
"	STOREHOUSE	20'×85'	" - 346
POST OFFICE	BLDG.	40'×100'	" - 374
"	BARRACK	20'×60'	" - 313,314
"	MESS	20'×36'	" - 315
"	LAVATORY	20'×14'	" - 349
TELEPHONE & TELEGRAPH	BLDG.	20'×21'	" - 328
"	OPERATORS' "	20'×24'	" - 338
FIRE STATION		24'×27'	" - 365
WAR RISK INSURANCE	OFFICE	20'×48'	" - 396
CLOTHG. SHOE REP'R. & PRINTS SHOP		20'×40'	" - 381

NOTE:- ALL LATERAL SEWER PIPES TO BE 6" UNLESS OTHERWISE LABELLED.
" ALL SERVICE PIPES TERMINATE 5 FEET FROM BUILDINGS.

WATER
SEWER
MANHOLE
HYDRANT
HOSE REEL
GREASE TRAP

SCALE 100' 50' 0 100' 200' 300' 400' 500'

CONSTRUCTION DIVISION WAR DEPT. WASHINGTON, D.C.

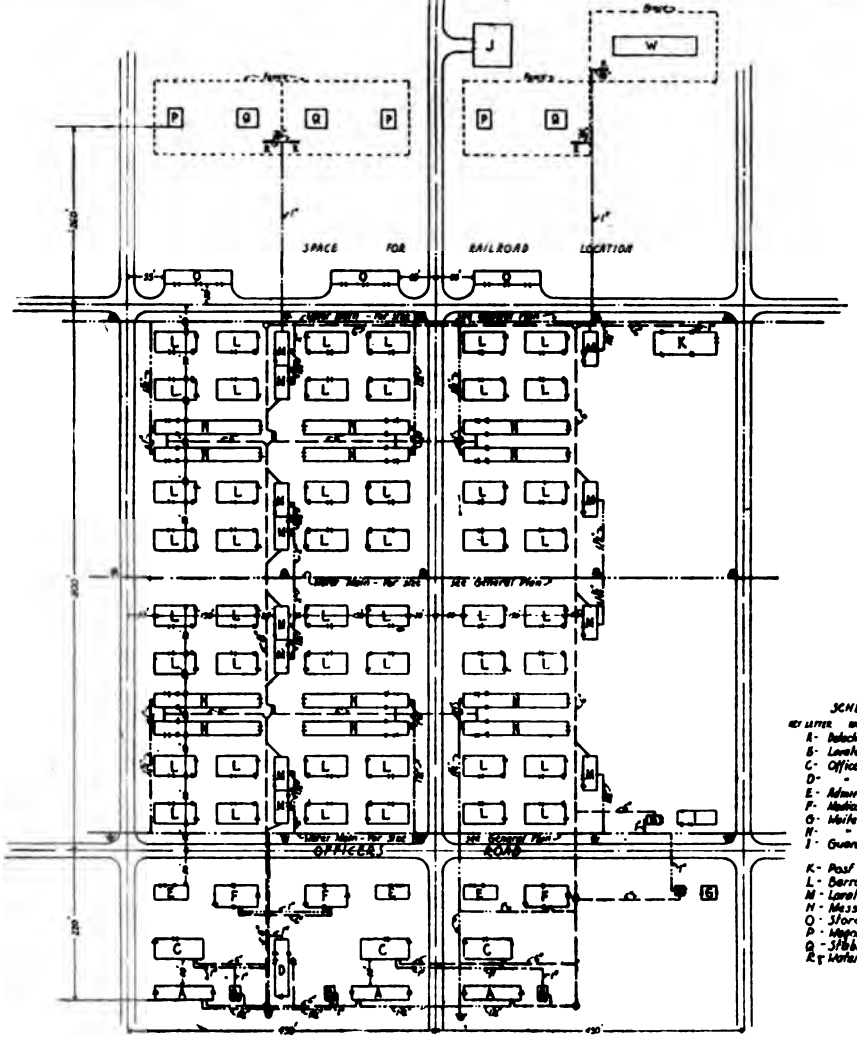
CANTONMENT GROUNDS
TYPICAL PLAN FOR CAMP CENTER

JOB NO. 610 DATE FEB. 22, 1918.
PLAN NO. 232. APPROVED BY H.G. Trust

DATE	REVISIONS	APPROVED
April 24, 1918	Building location changed	
" 25, "	Detail of Sewer added	

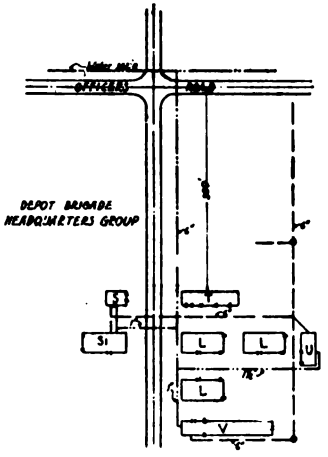
DESIGNED BY G.B.I.B.S. JR. DRAWN BY K.W. BLANCHARD CHECKED BY H.G. Trust NUMBER 610-232

SECTION C. PLATE 15



— LEGEND —
Water Pipe
Sewer Pipe
Manhole
Hydrant
Grease Trap
Hose Reel

Note:- All Service Pipes terminate 5' from Buildings
All Lateral Sewers to be 6", unless otherwise labelled.



SCHEDULE OF BUILDINGS

KEY LETTER	KIND OF BUILDING	SIZE	FILE & PLAN NO.
A -	Detachment Barrack	20'×86'	C20-355
B -	Lavatory	20'×16'	"-349
C -	Officers Quarters	30'×70'	"-343
D -	" Mess	20'×84'	"-346
E -	Administration Building	20'×93'	"-336
F -	Medical Building	25'-6"×63'	"-302,303,304,305,306.
G -	Waiters Barrack	20'×21'	"-353
H -	" Lavatory	14'×14'	"-349
I -	Guard House	20'×36'	"-331
K -	Post Exchange	32'×91'	"-357,358
L -	Barrack	25'-6"×60'	"-345,344
M -	Lavatory	20'×49'	"-345
N -	Mess Hall	20'×154'	"-316
O -	Storehouse	20'×36'	"-348
P -	Mapag Shed	18'×29'	"-332
Q -	Stable	25'×30'	"-421
R -	Watering Trough	2'-6"×10'	"-423

DEPOT BRIGADE HEADQUARTERS
— SCHEDULE OF BUILDINGS —

KEY LETTER	KIND OF BUILDING	SIZE	FILE & PLAN NO.
S -	Officers Quarters	20'×28'	C20-349
S1 -	" "	30'×63'	"-356
T -	Administration Bldg	20'×84'	"-327
U -	Lavatory	20'×45'	"-345
L -	Barrack	25'-6"×60'	"-343
W -	Stable	25'×120'	"-421
R -	Watering Trough	2'-6"×10'	"-423
V -	Mess Hall	20'×133'	"-316
J -	Garage	65'×54'	"-322

Note:- This is a new drawing of same number dated Feb. 2, 1918.

CONSTRUCTION DIVISION WAR DEPT. - WASHINGTON, D. C.

CANTONMENT GROUNDS
TYPICAL PLAN FOR DEPOT BRIGADE

JOB No. 610 DATE SEPT. 5, 1918.
PLAN No 233 APPROVED BY [signature] MAJOR GEN. U. S. A.

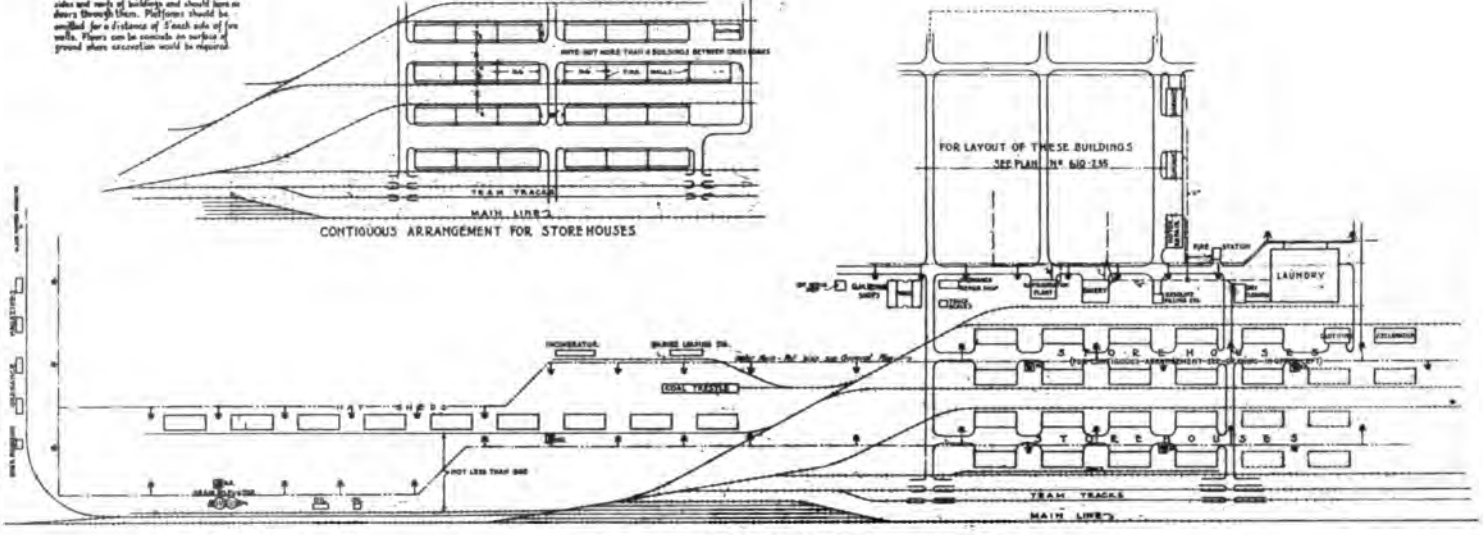
DATE	REVISIONS	APPROVED

DESIGNED BY [signature] DRAWN BY [signature] TRACED BY [signature] CHECKED BY [signature] NUMBER 610-233

SECTION C, PLATE 16

NOTE:
Storehouses should in no case be placed less than 100 apart each way unless built contiguous with 12" brick fire walls between. Space between storehouses must not be filled with standing freight cars. No store house to contain more than 10000 sq ft floor space as per plan 620-339, showing building 20×166. Fire walls should extend 3 beyond sides and ends of buildings and should have no doors through them. Platforms should be omitted for a distance of 5 each side of fire walls. Floors can be omitted on surface of ground where excavation would be required.

CONTIGUOUS ARRANGEMENT FOR STOREHOUSES



Schedule of Tracks (Approximate only)	Length
(1) A Sorting and Storage Yard and Switching Track (Actual % to be reduced if yards and sidings are extended)	10000 Ft.
(2) Storehouse Tracks to reach 21 buildings	12,000 Ft.
(3) Team Tracks for unloading direct to vehicles	5000 Ft.
(4) A Siding to a remote side for Magazines	1000 Ft.
(5) A Siding to Grain, Oil, and Stables	1000 Ft.
(6) A Siding to Hay Sheds	2000 Ft.
(7) A Siding to Coal Trestle and Incinerator	1000 Ft.
Total -	34000 Ft.

NOTE-ALL LATERAL SEWER PIPES TO BE 6" UNLESS OTHERWISE LABELED.
NOTE-ALL SERVICE PIPES TERMINATE 5 FEET FROM BUILDINGS.

WATER ——————
SEWER ——————
MANHOLE ——○——
HYDRANT ——▲——
HOSE REEL H
GREASE TRAP —G—

SCHEDULE OF BUILDINGS

No.	Name	Size	Plan No.
1	Sanitary and Storage Yard and Switching Track	60'×165'	620-339-359
2	" " Quarantine	" " " "	" " " "
3	" " Construction Materials	" " " "	" " " "
4	Team Tracks - Miscellaneous	" " " "	" " " "
5	" " " Embankments	" " " "	" " " "
6	" " " Reclamation	60'×165'	620-302-303
7	" " " Clearance	60'×165'	620-339-354
8	Hay Sheds	60'×165'×2	620-310
9	Grain Elevator	60'×165'	620-320-321
10	Incinerator Plant Shed	21'×28'	620-311-19
11	Q.M. Repair Shop (2 Bays)	each 24'×45'	620-350
12	Horse " "	60'×120'	620-288-289-293
13	Garages	45'×105'	620-322-291
14	Gasoline Filling Station	21'×21'	620-291
15	Dry Houses (Incinerator)	25'×60'	620-326
16	" " "	25'×36'	" "
17	Refrigeration Plant	72'×85'	620-329-330-331-332-333.
18	Bakery (Annex)	91'×105'	620-334-344.
19	Laundry	80'×270'	620-328
20	Dry Cleaning Establishment	49'×72'	620-9
21	Coal Trestle (to storage and Team tracks)	20'×200'	620-340
22	Incinerator	32'×102'	620-322
23	Warehouse (Commercial)	32'×36'	620-329
24	Warehouse (Commercial Isolation)	24'×60'	620-331
25	Black Powder Magazine	6'×8'	620-87
26	Trench "		
27	Car Repair Shop	36'×60'	620-486
28	Refuse Loading Station	32'×125'	620-453
29	Repacking Plant	40'×80'	620-335

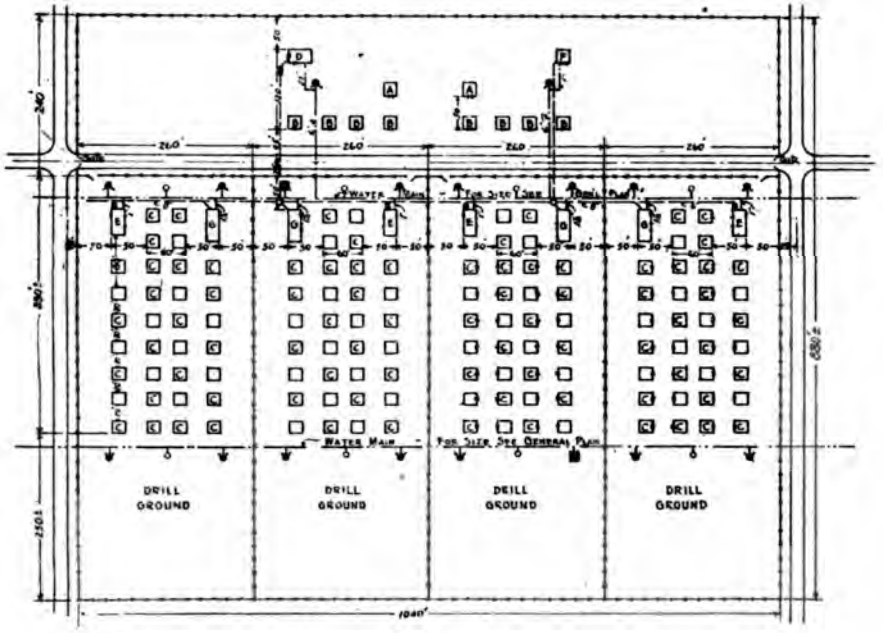
SCALE

CONSTRUCTION DIVISION-WAR DEPT.-WASHINGTON, D.C.
CANTONMENT GROUNDS
TYPICAL LAYOUT RAILROAD TERMINAL
JOB NO. 660 DATE APR 19-1918
PLAN NO. 238 APPROVED BY W. M. TAYLOR, QMG, NA

DATE	REVISIONS	DRAWN BY	CHECKED BY

DESIGNED BY — DRAWN BY — TRACED BY — RECOMMENDED BY — APPROVED BY

SECTION C. PLATE 17.



· SCHEDULE · OF · BUILDINGS ·

KEY LETTER	TYPE OF BUILDING	SIZE	FILE NO. & SD PLAN NO.
A	BATT. OFFICERS QUARTERS	20'-20'	324
B	Co. " "	20'-20'	324
C	HUT FOR MEN	20'-20'	324
D	KITCHEN FOR OFFICERS	20'-32'	339
E	" " MEN	20'-40'	339
F	LAVATORY " OFFICERS	20'-21'	348
G	" " MEN	20'-49'	345

DETAIL PLANS

CONSTRUCTION DETAILS	620 - 315-317
STOVES & RANGES	" - 329-330
HOT WATER HEATING	" - 351
ELECTRICAL SPECIFICATIONS	" - 367
LAVATORY DETAILS	" - 350
SINKS	" - 352
FENCE SHOWN THUS	" - 394
FENCE " "	12 BARBED WIRES

ON POSTS 6' HIGH AND 8' APART.

NOTE:- ALL LATERAL SEWER PIPES TO BE 6 UNLESS OTHERWISE LABELLED

NOTE:- ALL SERVICE PIPES TERMINATE 5 FT FROM BUILDINGS

WATER
SEWER
MANHOLE
HYDRANT
HOSE REEL
¾" YARD HYDRANT WITH WHEEL HANDLE
GREASE TRAP

SCALE

NOTE: THIS PLAN SUPERCEDES PLAN NO. 610-216.

CONSTRUCTION DIVISION WAR DEPT. - WASHINGTON, D. C.

CANTONMENT GROUNDS

PLAN FOR QUARANTINE CAMP FOR 1000 MEN

JOB No. 610 DATE JULY 23-1918

PLAN No. 274 APPROVED BY H. J. Brent MAJOR QMC. N. A.

DATE	REVISIONS	INIT.	APPROVED
Aug. 31, 1918	Buildings Added.		

DESIGNED BY | DRAWN BY | CHECKED BY | APPROVED BY | NUMBER
D.C. Hastings | S.C. Jeffress | E.G. Dickey | Chas. Gillespie Jr. | 610-274.

SECTION C. PLATE 18

ROADS AND RAIROADS

ROADS.

WIDTH.

The widths of roads should be governed by the number of lines of traffic which must b accommodated, and the speed at which they move; more clearance being required for traffi moving at high speed, which is defined as speed greater than fifteen miles per hour. The 5-to truck used by the Army has over-all dimensions of 7 feet 6 inches by 21 feet. Trucks of thes maximum dimensions require at least 2 feet 6 inches for clearance at a speed of twelve miles pe hour, which fixes the widths of roadway for this kind of traffic at 20 feet.

Where mule teams or light automobiles constitute a large percentage of the traffic, and when the width of vehicles is not above 6 feet 3 inches, a width of roadway of 18 feet is sufficien: Widths less than 18 feet should not be used unless traffic be light, slow-moving, and the roadwa: constructed with substantial shoulders of bituminous or gravel macadam; the consideration bein that any light traffic roadway may suddenly be used by heavy traffic, due to its use as a detour, o a change in conditions.

There is considerable difference of opinion as to the location and width needed for warehous roads. A 5-ton truck when backed up square to a warehouse platform, requires 33 feet in whic' to turn. A maximum width of 42 feet, therefore, is sufficient for backing and turning; and fo this class of traffic, the main road should have a width of 24 feet with wings of 18 feet oppc site the platforms. Manure loading platforms require a width sufficient for one line of traffi only, as do the coal trestles and ordnance storehouses.

Roads to trestles, incinerators and can-washing plants should be arranged in loops to affor continuous movement of traffic with ample loading space.

At all curves of less radius than 400 feet, the width of the pavement should be increase from two (2) to four (4) feet or more, and the surface should be banked.

THICKNESS.

Thickness of concrete pavement should be governed by width, traffic, usage and foundatio conditions. In conection with foundations, the following items should be considered: (a density of soil; (b) tendency towards shrinkage; (c) tendency toward settlement in fills; (d drainage and danger of washouts; (e) elevation of ground water. Limits of thickness for differ ent widths of roads are shown on cross-section.

TYPE.

In the selection of the kind of pavement to be used, consideration should be given first t availability of material, with a view to avoiding, as far as possible, transportation of material or machinery by rail for long distances. Secondly, the material; concrete, brick, asphaltic con

crete, bituminous macadam, and waterbound macadam of gravel or broken stone, should be selected in the order named, with reference to the estimated density of traffic. At the divisional warehouses, where much turning of vehicles occurs, concrete, brick or other hard surfaced pavement is to be preferred. At incinerators, fire stations, etc., where vehicles are washed, or at manure loading platforms, concrete or brick is preferable for sanitary reasons.

GRADES.

No definite limit as to the maximum grades permissible on roads within Army camps has been fixed. It has been the practice to favor the location of roads in such a manner that cuts or fills of more than 3 feet in depth would be avoided. A cut or fill of greater depth than 3 feet may be justified, however, if thereby a short, steep grade of 4 per cent or more, or a long grade of 5 per cent or more may be avoided. No grade steeper than 5 per cent is permissible on roads to be traversed by horse-drawn artillery.

ALIGNMENT.

In general, roads should be located on the most direct line between the points to be served, where the topography is such that the above-mentioned limits as to the maximum permissible cuts and fills can be followed. At sharp curves or intersections where the view of the roadway is obscured by high banks, trees, hedges, or buildings, the road should be widened and, as far as possible, all obstructions cleared. Roads should never be located so near buildings that there is insufficient room for road gutters.

CURVATURE.

The radius of curvature at intersections should not be less than 15 feet, while on main traffic roads it should not be less than 200 feet. The traffic is presumed to move at a speed of 15 miles per hour.

MATERIALS.

Note—These instructions are not to be considered as adequate specifications for materials to be furnished or for work to be done under the lump sum form of contract.

Detailed specifications for use in connection with lump sum contracts for road work will be furnished on request by the Washington office.

CEMENT.

Cement is to conform to the requirements of the "U. S. Government Specifications for Portland Cement," adopted January 1, 1917, and any subsequent amendments thereto.

SAND.

The sand, or its substitutes, for concrete is to be of such quality that the strength of a 1-3 mix will be that of a similar mix made of "Standard Sand."

SCREENINGS.

Screenings may be substituted for a portion of the concrete pavement sand, providing they are obtained from hard, tough, durable rock, well-graded from fine to coarse with the coarse

particles predominating, and free from dust coating and other dirt. All sand and screenings shall pass a ¼" mesh screen.

GROUT SAND.

Grout sand is to be a sand of which 100 per cent passes a No. 20 sieve and not over 30 per cent a No. 100 sieve. It should not contain more than 5 per cent loam or silt.

CUSHION SAND.

Cushion sand is to be a sand of which 100 per cent passes a No. 6 sieve, and 90 per cent passes a No. 20 sieve; an excessively fine sand should not be used, nor should it contain more than 15 per cent loam or silt.

STONE.

The broken stone or gravel for concrete should be of durable rock, and should not be greater in any dimension than 2½ inches and of such size as to be retained on a ¼-inch mesh screen.

GRAVEL.

Gravel for concrete pavements should be meshed or screened if necessary, and the coarse and fine aggregates suitably proportioned so as to produce a well-graded material.

SLAG.

Slag used for concrete aggregate should be air-cooled blast furnace slag and should be free from lumps of iron, rubbish or foreign matter. In size the slag should range from that passing a 2½-inch ring to that retained on a ¼-inch screen.

BITUMINOUS MATERIAL.

Bituminous material should be of standard brands, the product of a manufacturer of at least two years experience. Asphaltic cement, refined tar, or bituminous material, should be of brands which have been in successful continuous use in bituminous asphaltic pavements for at least two years. Requirements for this material differ in various sections of the country, depending upon climatic conditions, volume of traffic, stone, etc.

PAVING BRICKS AND BLOCKS.

The bricks or blocks should be specially burned for street paving, particular attention being given to hardness, toughness, straight lines and non-absorption of water. When broken, the bricks or blocks should show a dense, stone-like body, uniform in color, and free from lumps of uncrushed clay, lime, air pockets, cracks or marked laminations. Kiln marks must not exceed 3/16 of an inch in depth, and these marks shall not show on more than one face. If the edges of the block are rounded, the radius should not exceed 3/16 of an inch. They should have one fairly straight face and be provided with not less than two, nor more than four projections on one side of the brick, which should not project more than ¼ of an inch, nor less than ⅛ of an inch. The bricks or blocks should not vary more than ⅛ of an inch in width or depth, nor more than ½ of an inch in length. The bricks or blocks must not vary more than ⅛ of an inch one from the other, in any one shipment.

GRANITE BLOCKS.

Granite blocks should be uniform in toughness and texture, without seam or scales and of the following dimensions: Not less than 8 inches nor more than 12 inches in length; not less than 3½ inches nor more than 4½ inches in width, and not less than 5 inches nor more than 5½ inches in depth. The crushing strength should not be less than 20,000 pounds per square inch.

The blocks should be so dressed that after laying, no measurement of any joint will show a width of more than ½ inch. The heads of the blocks should not have any depressions of more than ⅜ of an inch in the general surface, and the edges and corners must be full, unchipped and unbroken.

VITRIFIED PIPE, UNDER-DRAINS.

Sewer pipe should be salt-glazed, sound vitrified "stone-ware," with bell joints.
Pipe for under-drains should be of 4 inch porous tile.

METAL REINFORCEMENT, CASTINGS.

Metal reinforcement should be free from grease, injurious rust, dirt or other foreign matter. Iron castings should be of the best tough gray iron of uniform quality, and should be reasonably free from defects, and uneven shrinkage.

WOODEN GUARD RAILING.

The posts may be of seasoned white oak, cedar, locust, tamarack, white pine or chestnut. The rails should be of seasoned planed spruce or other similar wood.

METHODS OF CONSTRUCTION.

PRELIMINARY.

Preliminary to the road construction, the drainage structures should be constructed or repaired; manholes, valve boxes, sewer pipe lines, water pipes and all appurtenances should be adjusted to their final locations.

In general the road work consists of clearing, grubbing and grading the site; shaping the roadway shoulders and ditches; building sub-drains, culverts and catch basins; and constructing foundations and surfacing of such kinds, widths and thicknesses, as are shown on typical cross-sections for roads, Plates 19 and 20.

FILL; GRADING.

Material, where required for fill, may be taken from the sides of the roadway, or from borrow-pits giving the minimum haul. All boulders, muck, soft clay or spongy material, which will not consolidate under the roller, should be removed from the sub-grade. Where fill is to be placed, the existing slopes and surfaces should be plowed or scarified. If the filling be less than two feet in depth, all vegetable matter is to be removed from the original surface. Where the road surfaces are to receive concrete, they should be thoroughly rolled with a self-propelled roller, weighing not less than ten tons, until an even and firm surface is produced, in accord-

ance with the lines of cross-sections. All sub-grades shall be properly drained. Under-drains should be covered to a depth of not less than one foot with gravel or stone. Sod, sticks, roots, or any vegetable or spongy material must not be used in forming embankments. Embankments should be constructed in horizontal layers, not exceeding twelve inches in thickness, and each layer should extend across the entire fill and be thoroughly compacted by rolling or tamping.

CONCRETE MIXING AND PLACING.

The volume of sand, broken stone or gravel should be measured to insure uniform proportions for each of the materials at all times. A sack of Portland cement (94 lbs. net) is to be considered as one cubic foot.

Approved batch mixers should be used. The materials are to remain in the drum for at least one minute before any part of the batch is discharged. The quantity of water used in mixing the concrete should be suited to the construction and such as to produce a uniform, dense and impervious concrete. The operation of compacting is to be conducted as soon as possible after depositing the concrete.

Note—Air-cooled, blast furnace slag may be used for concrete aggregate under suitable conditions. The slag must be first so soaked with water that it will absorb no more, and in this condition placed in the mixer. In mixing, place water in the mixer first and mix somewhat longer than when stone is used.

FORMS.

The concrete should be deposited in suitable forms, rigidly constructed.

FREEZING.

When the temperature falls below 35 degrees Fahrenheit, the fine aggregate, the water and the coarse aggregate should be heated, and the newly laid concrete covered with canvas or straw, or otherwise protected from freezing. Concrete for pavements should not be laid when the temperature is below 35 degrees Fahrenheit.

CONCRETE PROPORTIONS.

The concrete used for road work is classified as follows: (the percentage of voids having been determined and proportions varied accordingly.)

Class A is to be composed of one part cement, two parts sand, three parts broken stone or gravel. (1-2-3)

Class B is to be composed of one part cement, two parts sand, four parts of broken stone or gravel. (1-2-4)

Class C is to be composed of one part cement, three parts sand, six parts broken stone or gravel. (1-3-6)

Class A only should be used in the construction of cement concrete pavements.

Class B in the construction of curbing, walks, etc.

Class C in foundations, walls, abutments and foundations for pavements.

RIP-RAP.

Rip-rap should consist of field or quarry stone as cubical in form as is practicable, the largest stones placed first and the spaces between the larger stones filled with spalls.

GUTTERS.

Cobble gutters should be made of rounded "hardheads," quarry or field stone, set on edge, embedded in the same material that is to form the joints. Concrete gutters should be of Class "B" concrete. Care should be taken that gutters conform to true line and grade.

CONCRETE EDGING AND CURB.

Concrete edging is to be of Class "B" concrete. Concrete should be of such consistency, and so spaded and worked, that a smooth mortar face is produced. Curbing should be moulded in place in sections 6 feet long, 18 inches deep and 8 inches thick.

CONCRETE FOUNDATION COURSE.

Upon the sub-grade hereinbefore described under heading, "Fill and Grading," the concrete is to be placed, first sprinkling the surface sufficiently to dampen it, but a muddy condition should not be allowed. Class "C" concrete should be used for foundation. Substantial forms should be provided to hold the concrete. The surfaces, when completed, are to conform to the lines and grades shown on the cross-sections and must be free from depressions and irregularities. As soon as the concrete has hardened, the surface should be temporarily covered with a one-inch layer of suitable material, which should be kept moist for a period of at least seven days before spreading the cement sand bed.

BOTTOM COURSE.

(a) Old Macadam Surface:

In case the top course is to be constructed upon an old macadam surface, the surface should be cleaned of all earth and refuse and scarified to a satisfactory depth, then the surface of the roadway should be built up with loose stone to the proper cross-section. The macadam should be compacted by rolling with a self-propelled roller weighing not less than ten tons, until an even and firm surface is produced. If necessary, in order to satisfactorily compact the stone, the macadam is to be sprinkled during the process of rolling.

(b) Broken Stone, Slag, or Gravel Bottom Course:

After the sub-grade or foundation course has been properly prepared, a course of broken stone, slag or gravel approximately 2½ inches to 3½ inches in any dimension, should be spread evenly, so that it will have, after rolling, the required thickness. This course should be thoroughly rolled with a self-propelled roller, weighing not less than ten tons. The rolling must begin at the sides and continue toward the center and be continued until the course is thoroughly compacted.

Sand or screenings should be uniformly spread upon the surface, swept in with rattan or steel brooms, and rolled.

CEMENT CONCRETE PAVEMENT.

DETAILS OF CONSTRUCTION.

Upon the sub-grade hereinbefore mentioned, under heading of "Fill and Grading," the concrete should be deposited rapidly to the required depth and for the entire width of the pavement in a continuous operation.

Transverse or contraction-expansion joints should be one-fourth inch in width, placed across the pavement at right angles to the center line. Catch basins, manhole tops, poles or other fixed objects which project through the pavement, should be separated from the concrete by a bituminous joint filler. Joints should be formed by inserting during construction (and leaving it in place) the required thickness of bituminous joint filler. Before the road is opened to traffic the joint filler should be cut off at a height ¼ inch above the surface of the road.

Heavy screeds or templates should be shaped to the cross-sections of the surface. The surface of the concrete may be finished with a float, belt, or light roller so as to insure a dense, compact surface. Where a float is used the work is to be done from a bridge which may rest on the forms or shoulders. Where a light roller is used, the length of the handle should be two feet longer than the width of the pavement. When the surface has become sufficiently hardened so that pitting will not occur, it is to be sprayed with water, and kept wet until an earth or other approved covering is placed. The covering material should be spread over the surface to a depth of one inch and kept moist by sprinkling for a period of ten days; then cleaned from the surface and the road opened to traffic.

BRICK PAVEMENTS.

TYPE 1.

DETAIL OF CONSTRUCTION.

Upon the foundation course hereinbefore described under heading of "Bottom Course," there should be spread a cushion bed of cement and sand, consisting of one part cement and four parts sand, the depth of which should be one inch after rolling. The cement sand bed is to be struck off with a template to the exact form shown on cross-sections, then rolled with a hand roller weighing about 300 pounds. Where depressions occur, they are to be filled in and the bed re-rolled.

On the cushion thus prepared, the brick should be set on edge, best edge up, straight, and at right angles to the edging line, except at road intersections, where they should be laid at such angles as are required by conditions. All brick should be laid with the lugs in the same direction and joints broken with a lap of not less than three inches.

After a sufficient number of brick have been laid, all soft, broken, or badly misshaped bricks should be marked and removed and, after all replacements have been made, the pavement should be thoroughly rolled with a self-propelled tandem roller weighing not over five tons and not less than three tons. The rolling should start along the outside edges and progress toward the center, then re-rolled diagonally both ways until the surface is even.

Grout for filling the joints of brick pavements is to be composed of one part Portland cement and one and one-half parts grout sand, of such consistency that it will readily flow into the joints without separation. Before the grout is applied the rolled bricks should be thoroughly sprinkled. After the joints are filled flush with the top of the bricks and sufficient time for hardening

has been allowed, the pavement should again be sprinkled, then one inch of suitable material spread evenly over the entire surface and kept moist for a period of at least ten days. During this period the section grouted must remain absolutely free from disturbance or traffic of any kind.

BRICK PAVEMENTS.

TYPE 2.

DETAILS OF CONSTRUCTION.

Upon the foundation course hereinbefore described, under heading "Concrete Foundation Course," the brick is to be laid in similar manner to method for Type 1. All the work of brick-laying should be done over the brick already laid. Tamping upon the foundation should be prohibited. Bricks slightly chipped on the corners, but otherwise good, may be used.

Immediately after inspection, the pavement should be rolled with a hand-roller weighing not less than twenty pounds per inch of length. The rolling should be kept close to the laying and should be continued until the surface is smooth. After the final rolling, the surface should be tested with a ten-foot straight edge, laid parallel with the center line of the roadway, and any depression exceeding ¼ of an inch should be corrected.

The general method of constructing a hillside pavement of wire-cut brick is to conform to standard practice, except that the brick should be laid longitudinally instead of transversely. They should be grouted in the manner specified for brick pavements, except that all the grout in the surface grooves of the wire-cut lug hillside brick should be broomed out before it has time to set up (care being taken not to disturb the grout in the longitudinal joints).

GRANITE BLOCK PAVEMENT.

DETAILS OF CONSTRUCTION.

The foundation course should be six inches thick, of concrete as hereinbefore described under heading "Concrete Foundation Course" and of similar section to that shown for concrete base under brick pavement.

There should be spread upon the foundation course, a bed of clean coarse sand; the sand bed conforming to the exact form of cross-section. This sand cushion should have a uniform depth of 1½ inches after being struck off, and should be prepared at least 50 feet in advance of the block laying. The blocks should be laid by the pavers standing upon blocks already laid and not upon the bed of sand.

The blocks should be laid in straight lines with the best edges up, at right angles to the axis of the roadway, except at intersections, where they should be laid at an angle of 45 degrees to the center line of the intersecting roadways. The blocks should be sorted and gauged; those of the

same width and depth being placed in consecutive courses across the full width of the road. The blocks should be set vertically on edge in close contact, each touching the adjoining block on sides and ends. All joints should be kept clean and open to the bottom until filled with the gravel grout. For granite block pavement construction, the number of rammers should be in the proportion of at least one rammer to every two pavers.

After the blocks have been brought to a uniform surface, the joints are to be filled with a grout composed of one part Portland cement and one part approved clean sand, graded from coarse to fine. If dry or heated atmospheric conditions so require it, the blocks should be sprinkled immediately before applying the grout. The grouting should follow the paving as closely as possible, and when well set, the surface should be covered with one inch of approved clean sand, or other acceptable material, to prevent too rapid drying of the filler. No traffic should be permitted on the pavement for a period of at least seven days after the grouting.

ASPHALTIC CONCRETE.

PRELIMINARY.

The foundation course should be of concrete as hereinbefore described, under heading "Concrete Foundation Course," or of stone as described under heading of "Bottom Course."

The asphaltic concrete wearing course should be laid upon the foundation, and when completed should be two inches in thickness. It should consist of a mineral aggregate mixed with asphaltic cement, laid as hereinafter described, and is, what is known as "Topeka Mix."

MATERIALS.

Mineral aggregate should consist of broken stone and sand, to which should be added as required stone dust or Portland cement.

Stone should be sound and durable, broken as nearly cubical as practicable, and should contain no foreign matter of any character. In case asphaltic concrete binder is used, the stone should pass a one-inch mesh screen and be uniformly graded from one inch down, free from dust.

Sand should be clean and hard grained. It should be so graded as to produce, in the finished surface mixture, the mesh requirements as hereinafter noted. It should contain fine material not more than five per cent by weight, passing the 200 mesh screen.

Dust or filler in the form of finely ground limestone or Portland cement may be added, but only in such quantities that the screenings of the total ingredients entering into the mix in no case shows over eleven per cent by weight, passing a 200 mesh screen.

Asphaltic cement used should in every respect conform to bituminous and asphaltic cement as hereinbefore described.

Asphaltic cement binder should be mixed as follows: The stone and sand previously described should be heated to a temperature of between 225 and 325 degrees Fahrenheit, in approved appliances. The stone and sand should be measured off separately, and then mixed with sufficient asphaltic cement herein described, in such proportions that the resulting aggregate will contain, by weight, material passing a No. 10 screen between twenty per cent and thirty per cent, and bitumen in quantity from five per cent to eight per cent of the entire mixture.

Asphaltic cement binder, when used, is to be laid as specified for laying top surface of asphaltic cement as hereinafter described, and is to have a thickness, after final compression, of 1½ inches.

The proportions of the various ingredients composing the asphaltic concrete are approximately as follows:

Bitumen	8 to 11%
Passing 200 mesh screen	5 to 11%
" 80 " "	7 to 25%
" 40 " "	11 to 36%
" 10 " "	7 to 45%
" 4 " "	10 to 20%
" 2 " "	up to 10%

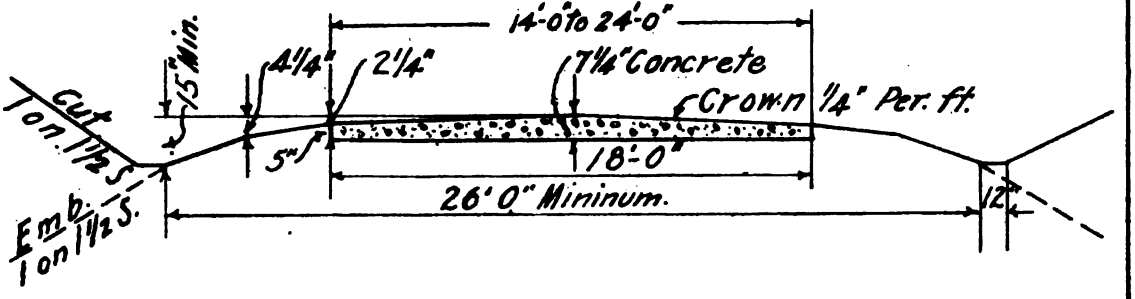
The bitumen and filler should be varied within the limits described, and the sand grading may be varied within these limits as rendered necessary by the character of the traffic and the sources of supply.

MIXING.

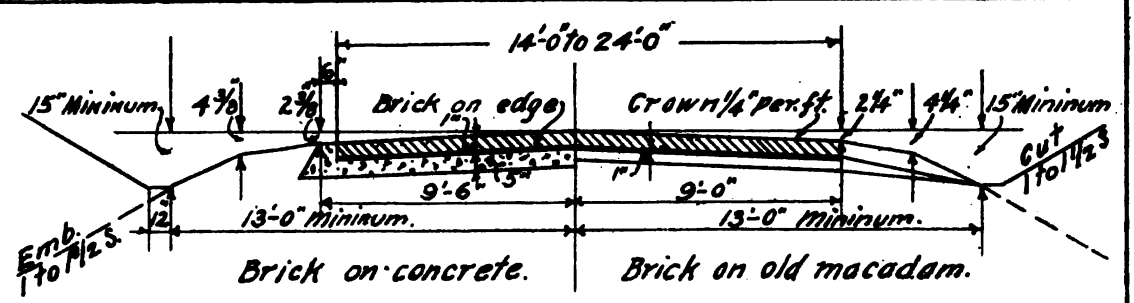
The sand and stone should be kept in separate piles at the foot of the cold sand elevator and should be fed into the elevator in accurate and definite proportions, as may be required to produce a mineral aggregate of the composition desired. The sand and stone should pass through a suitable dryer which will heat the material to a temperature of from 250 to 350 degrees Fahrenheit. The dryer is to be of such construction as to thoroughly mix the stone and sand. Before being run into the storage bin, the heated aggregate should pass through a suitable screen which will reject all pieces of stone or other material larger than that which will pass a 2-inch mesh sieve. The sand and stone, the filler, and the asphalt cement should all be weighed out in definite proportions. These proportions will depend upon the type of mixture desired. The accuracy of the scales and weighing boxes should be frequently verified. The mixing should be done in such a machine that a thoroughly homogenous mixture will be secured. The type of mixer known as the double pug-mill is preferable. The sand and stone should first be weighed out into the mixer, the dust then added cold, and finally the asphalt cement, heated to a temperature of from 275 to 325 degrees Fahrenheit. The materials should then be mixed until every particle of the mineral aggregate is completely coated with the asphalt cement, which process will require at least one minute.

LAYING.

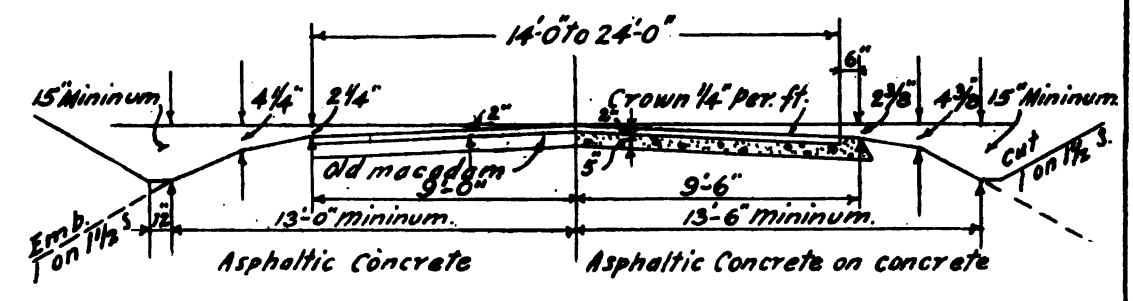
The surface mixture should have a temperature of from 225 to 350 degrees Fahrenheit upon reaching the road. The permissible range of temperature should be determined for each kind of asphalt to be used. All loads failing to fall within the permissible temperatures should be rejected at the road. The mixture should be dumped upon the base at some distance from the point at which the material is to be used. The mixture should then be shoveled into place and spread out by means of rakes and combed out thoroughly clear down to the base, in order that the wearing surface may be of uniform density at all points. The surface should be spread out to such a thickness that it will have the specified thickness after having received its final compression. The surface should then be rolled with a self-propelled roller, weighing not less than eight tons. It is permissible to smooth the surface with a lighter roller, but the final rolling must be done with a roller of the weight described above. After the first rolling the surface should be dusted with cement or other mineral dust. The rolling must be continued at the rate of not more than 200 square yards per hour, until no more compression is obtainable and the surface is free from waves, roller marks, and honey-combed spots. Where the width of roadway will per-



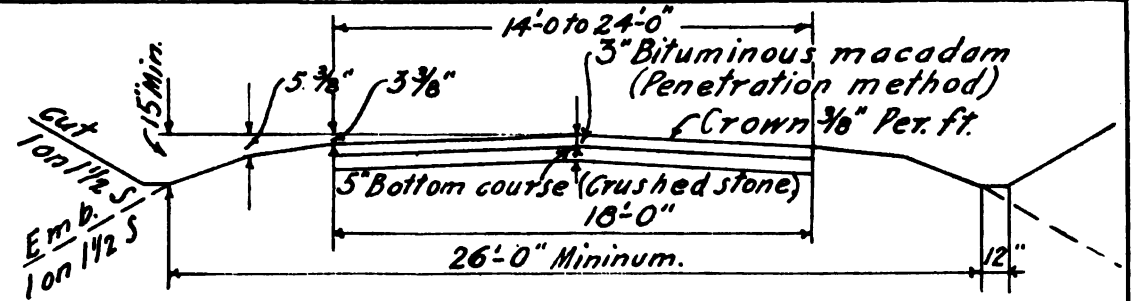
CEMENT CONCRETE PAVEMENTS.



BRICK PAVEMENTS.



ASPHALTIC CONCRETE PAVEMENTS.



BITUMINOUS MACADAM - PENETRATION METHOD.

CONSTRUCTION DIVISION OF THE ARMY

ROADS

TYPICAL CROSS SECTIONS

mit, the street should be cross-rolled. Around manholes and other fixtures where the roller cannot reach, compression may be obtained by using hot iron tampers. All gutters and street fixtures should be painted with hot asphaltic cement before the top is laid, in order to secure proper adhesion at the joint and to prevent the entrance of water into the joint. No asphalt should be laid in the rain or on a wet base.

BITUMINOUS MACADAM.

DETAILS OF CONSTRUCTION.

Upon the foundation course, hereinbefore described under heading "Bottom Course," a course of 2½-inch broken stone should be evenly spread. This course, when completed, should be 3 inches in thickness. The stone should be hard, durable rock, free from mud, dust and disintegrated matter. If any stone, after being spread, becomes wet or dirty, it should be removed and replaced with clean stone before the bituminous material is applied. This course should be compacted by a self-propelled roller, weighing not less than ten tons, after which bituminous material of a penetration of not less than ninety, nor more than one hundred and ten degrees Fahrenheit, should be evenly spread over the surface by the use of an approved pressure distributor. The quantity of bituminous material to be used in this application should be one and one-quarter (1¼) to one and one-half (1½) gallons per square yard. In order to insure uniformity at junction point of two applications, it is required that the distributor should, in starting, lap back on the previous application, covering the lap with building paper so as to avoid either an excess or an insufficient quantity at the junction point. The surface should then be immediately covered with a layer of clean, approved, one-inch stone, after which it should be compacted with a self-propelled roller weighing not less than ten tons; this layer of one-inch stone should be sufficient to fill the voids in the coarser stones.

The rolling should be continued until the course of stone is thoroughly compacted and its surface conforms to the established grade.

After this course has been satisfactorily rolled, a sealing coat, of ¾ gallon of bituminous material per square yard, should be applied by means of an approved pressure distributor.

This coat should be immediately covered with approved dustless screenings, spread and broomed about and rolled. This rolling should be continued until a uniform, smooth surface is produced, after which the road may be opened up to traffic.

WATERBOUND MACADAM.

DETAILS OF CONSTRUCTION.

Upon the foundation course hereinbefore described under heading "Bottom Course," a course of broken stone or slag, approximately two and a half inches in any dimension, should be spread evenly, so that it will have after rolling the required thickness, together with the

binder necessary to properly fill and bind the course. The binder should consist of screenings, or screenings and slag mixed. Care should be exercised in the spreading of the stone or slag, that no irregularities in the contour may develop in the rolling; all such irregularities as may occur should be removed before adding the smaller material. The rolling should be done with a self-propelled roller, weighing not less than ten tons, and should be continued until the layer of stone or slag does not creep or wave ahead of the roller.

After the stone or slag has been satisfactorily compacted, a light coating of binder should be spread on dry, by shoveling from piles previously placed along side the pavement, and immediately swept in and thoroughly rolled.

The spreading, sweeping and rolling should be continued until the spaces refuse the dry binder material, after which the macadam should be sprinkled and immediately rolled.

More screenings should be added where necessary, and the sweeping, sprinkling and rolling should be continued until a grout has been formed over the whole section of the macadam. This portion of the road should be left to dry out. The macadam should be repuddled and back rolled on succeeding days as often as may be necessary to secure satisfactory results.

GRAVEL ROADS.

DETAILS OF CONSTRUCTION.

The sub-grade should be prepared as hereinbefore described under heading "Fill and Grading."

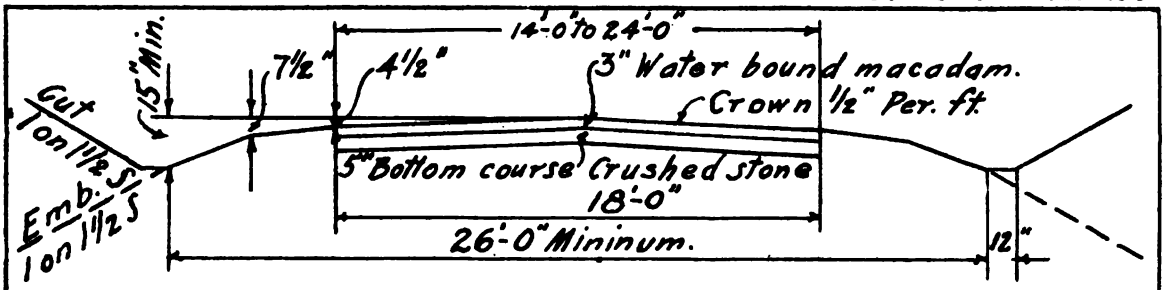
The gravel used should consist of hard, durable particles of stone, mixed with sand and clay, or other bonding material. Not less than 55 per cent nor more than 75 per cent, by weight, of the gravel should consist of stone particles sufficiently large to be retained on a ¼ inch mesh screen.

The material passing a ¼ inch mesh screen should consist of sand and clay, or other bonding material which, when tested in the manner described in Department Bulletin No. 347, "Methods for the Determination of the Physical Properties of Road Building Rock" (page 15), should have a cementing value of not less than 50. This material should not contain more than 33 per cent, by weight, of clay.

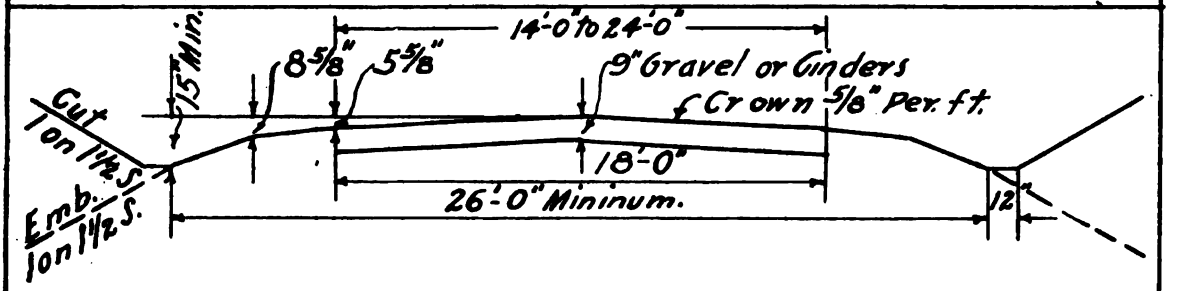
The gravel for the first course, hereinafter designated as "No. 1 Gravel," should not contain any particles which would be retained on a screen having circular openings two and one-half inches in diameter. The gravel for the wearing course, hereinafter designated as "No. 2 Gravel," should not contain any particles which would be retained on a screen having circular openings one and one-half inches in diameter. If necessary, the gravel should be screened to remove any excess of either fine or coarse material which it may contain above the limits specified.

First Course.

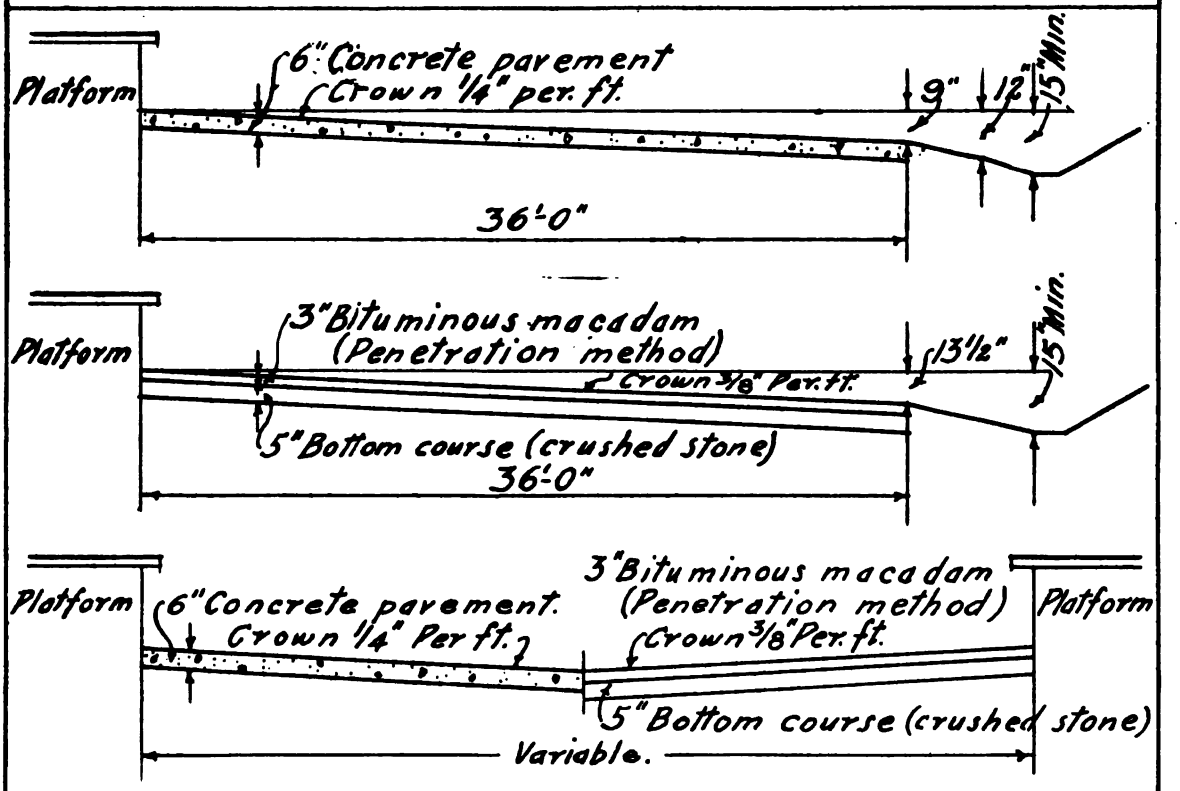
The first course should consist of a single layer of No. 1 gravel, spread uniformly to such a depth that when compacted it will have the thickness shown on the cross-section. The gravel should be spread by hand from dumping boards. After the gravel has been spread, it should be harrowed with a tooth harrow until the different-sized particles and the cementing material are evenly distributed through the mass. It should then be rolled, with an approved roller



· WATER BOUND MACADAM PAVEMENTS ·



· GRAVEL AND CINDER ROADS ·



· WAREHOUSE ROADS

CONSTRUCTION DIVISION OF THE ARMY

ROADS

TYPICAL CROSS SECTIONS

CONSTRUCTION DIVISION OF THE ARMY.

ROADS.

QUANTITY OF MATERIAL.

QUANTITY of MATERIAL PER LINEAL FOOT.

CONCRETE PAVEMENT.			
Width Feet	Cement Bbls.	Sand Cub. yd.	Stone Cub. yd
1.2.4. Mix.			
14	0.3809	0.1016	0.2285
16	0.4445	0.1185	0.2667
18	0.5105	0.1361	0.3063
20	0.5787	0.1543	0.3472
24	0.7223	0.1920	0.4334
1.-2.-3 Mix.			
14	0.4418	0.1320	0.1955
16	0.5156	0.1541	0.2282
18	0.5951	0.1770	0.2620
20	0.6713	0.2006	0.2971
24	0.8378	0.2504	0.3708

BITUMINOUS MACADAM PAVT.				
Top 2½" Stone.	Bottom 2½-3½"	Filler 1" Stone	Screenings.	Binder
0.1728	0.2881	0.0285	0.0194	3.5
0.1975	0.3292	0.0326	0.0222	4.0
0.2223	0.3705	0.0367	0.0250	4.5
0.2469	0.4116	0.0407	0.0278	5.0
0.2963	0.4937	0.0489	0.0333	6.0

WATER BOUND MAC.		
Top 2½" Stone	Bottom 2½-3½"	Screenings.
01728	0.2881	0.0864
0.1975	0.3292	0.0987
0.2222	0.3705	0.1111
0.2469	0.4116	0.1234
0.2963	0.4937	0.1481

THICKNESS.

CONCRETE.			BIT MAC.		Crown ⅜" per. foot.	W.B. MACADAM.		Crown ½" per. foot.
Width feet	Center	Side	Top Course	Bottom Course.		Top Course	Bottom Course.	
14'	6¾"	5"	3"	5"		3"	5"	
16'	7"	5"	3"	5"		3"	5"	
18'	7¼"	5"	3"	5"		3"	5"	
20'	7½"	5"	3"	5"		3"	5"	
24'	8"	5"	3"	5"		3"	5"	

BITUMINOUS MAC.		WATER BOUND MAC.
Top Course	2½" Stone	1½"-2½" Stone.
Bot. "	2½"-3½" "	2½"-3½" " .
Filler	1" " .	Screenings with dust.
Screenings Dustless.		

SECTION C., PLATE 21

weighing not less than ten tons, until it is thoroughly compacted and firm. The rolling should begin at one edge of the course, one rear roller wheel overlapping the shoulder from 2 to 6 inches, and progress gradually to the center of the road in such manner as to insure the uniform compacting of the gravel. The rolling should then begin at the opposite edge and proceed as above. All irregularities and depressions that may develop should be corrected immediately by reharrowing and adding No. 1 gravel, and the rolling so maintained until the second course of gravel has been spread.

Wearing Course.

After the first and intermediate courses of gravel have been rolled as specified, the earth shoulders should be built up or reshaped to conform with the finished cross-section of the road, and the wearing course, consisting of a single layer of No. 2 gravel, should be spread uniformly to such a depth that when compacted it will have thickness shown on the cross-section. The methods specified for spreading, harrowing, rolling and correcting irregularities and depressions in the first course should also apply to the wearing courses, except that the rolling for the latter should begin on the shoulder, at least two feet from the edge of the gravel.

When the gravel surfacing and shoulders have been rolled until thoroughly compacted and have been brought to the required cross-section, the surface should be sprinkled with water from properly constructed sprinkling wagons and again rolled according to the method already described. The amount of water used should be sufficient to wet the gravel but put on in such quantity and manner as not to wet and soften the sub-grade. Sprinkling and rolling should be continued until the surface is thoroughly bonded.

CONCRETE WALKS.

DETAILS OF CONSTRUCTION.

Concrete sidewalks should be not less than 4 feet nor more than 8 feet in width, which widths should be governed by location, amount and kind of traffic. The ground should be cleaned and prepared to receive the concrete, and the sub-grade thoroughly compacted to a firm and solid foundation five inches below and parallel to the finished grade of the walk. Care should be taken that the foundation is suitable in every respect, and that proper drainage is provided where necessary by the use of porous tile underdrains.

Materials and methods for the construction of walks, in general, should be similar to those herein contained for road work. The base should be not less than four inches thick, of a mix equal to 1, 3, 5 concrete, and should be laid between suitable forms. The wearing surface should be one inch thick; composed of one part cement, one part stone dust from ¼ inch mesh sieve, and one part coarse screened sand. Expansion joints should be carefully provided ¼ inch wide and in no case a greater distance apart than width of walk. All edges at joints should be neatly rounded.

RAILROADS.

LOCATION, GRADE, CURVATURE.

The main railway line to serve a cantonment, or other emergency project, should be so located that the amount of excavation and fill balance. The maximum grade of 2 per cent has been established for main service lines, although under extreme conditions a greater grade may be warranted. The maximum rate of curvature for main service lines has been limited to 10 degrees. No. 8 frogs should be used for turnouts or side track connections.

YARD TRACKS.

Tracks in yards will usually be constructed by the Government, although in some cases the railroad company operating the main service track will construct the yard tracks. Trackage in yards should have a minimum capacity equal to twice the maximum number of cars received per day.

CONTROLLING DISTANCES.

The minimum distance, center to center, between parallel tracks, should be not less than 13 feet. The distance between the center of an unloading track and that of a main line or running track should be not less than 14 feet, and preferably 16 feet if sufficient space is available. The distance from the center of a track to the edge of an unloading platform should be not less than 6 feet 2 inches. The height of floor of an unloading platform above the top of rail should be 3 feet 9 inches.

GRADE OF SIDE TRACKS.

If practicable, the maximum grade for a side track should be 0.4 of one per cent. A de-rail or de-rail switch should be installed in a side track which is laid at a grade greater than 0.4 of one per cent.

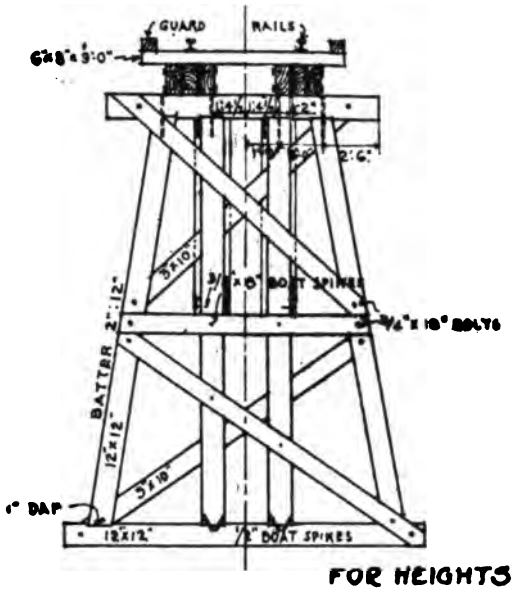
MATERIALS AND METHODS.

PRELIMINARY.

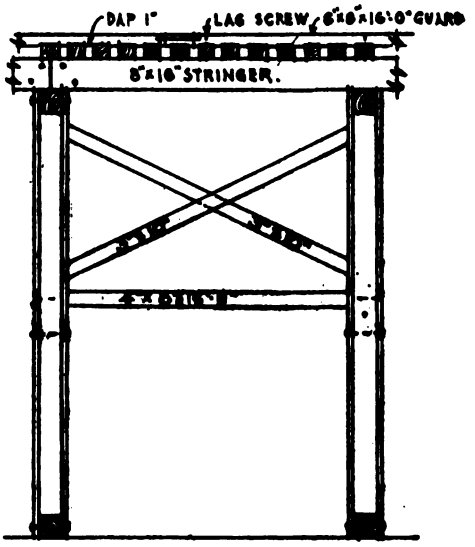
The work covered by these instructions consists of grading for embankments and formation of the roadbed; ditching; diversions of roads and streams; laying and surfacing all tracks; foundation pits and all similar works pertaining to the construction of the railway, its side tracks and station grounds. Standard cross-sections of roadbed and trestles are included in this Manual and with "Professional Papers No. 32, Corps of Engineers, U. S. Army," "Military Railways, Revised Edition, 1917," are to be taken as a general guide for materials and for the construction of military railways.

DITCHING.

Ditches should be formed at the bottom of slopes according to standard cross-sections, or such modifications thereof as may be required by conditions. Ditches should be neatly made and

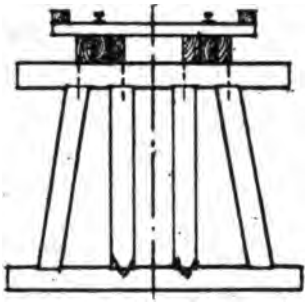


ELEVATION OF BENT

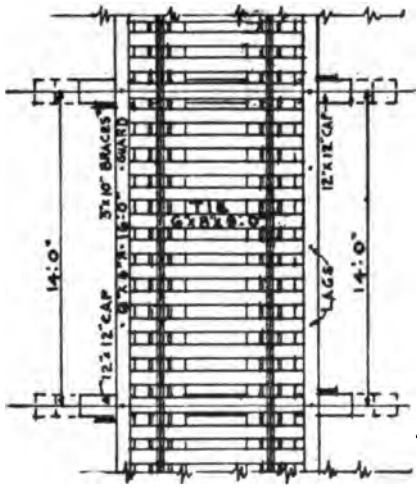


SIDE ELEVATION

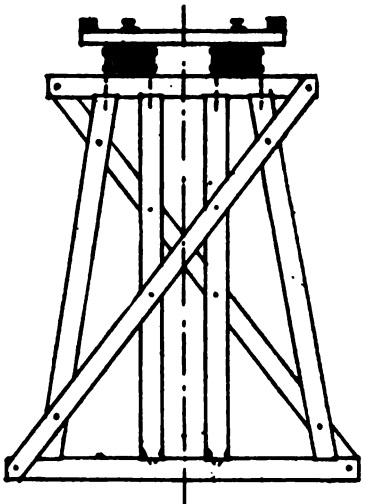
FOR HEIGHTS 18' TO 26'



FOR HEIGHTS 10 FT & LESS.



PLAN

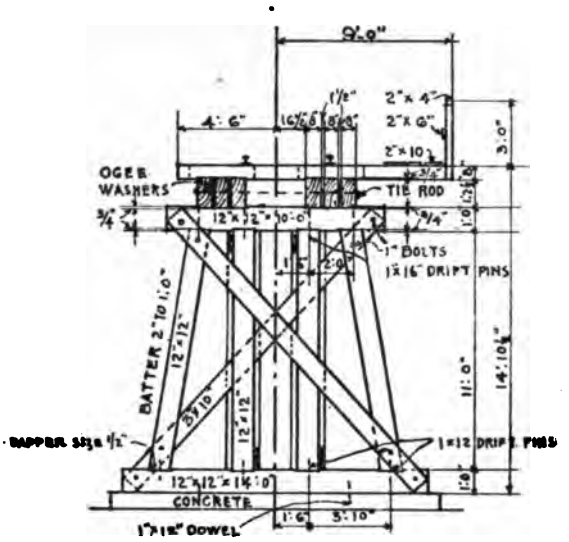


FOR HEIGHTS 10 FT TO 18 FT

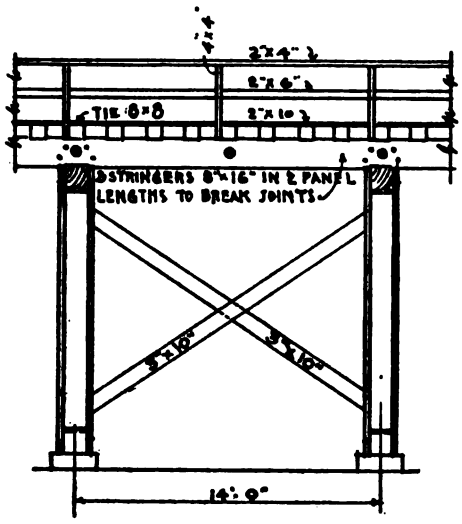
FOR ORIGINAL SEE DRAWING G17-26

CONSTRUCTION DIVISION OF THE ARMY

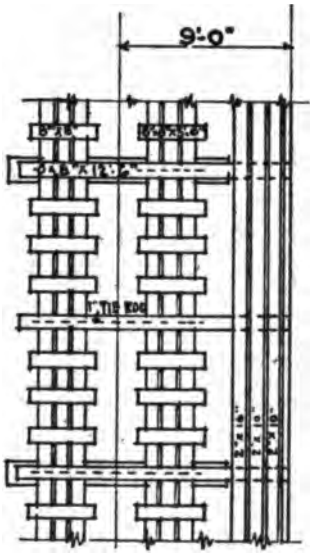
STANDARD RAILWAY TRESTLE



ELEVATION OF BENT



SIDE ELEVATION



PLAN

NOTES

POSTS SIZED OR DAPPED INTO CAPS AND SILLS.

TIES FASTENED TO STRINGERS WITH ¾"x12" LAG SCREWS.

STRINGERS FASTENED TO CAPS WITH ¾"x 22" DRIFT PINS

EVERY 3RD SPAN BRACED LONGITUDINALLY.

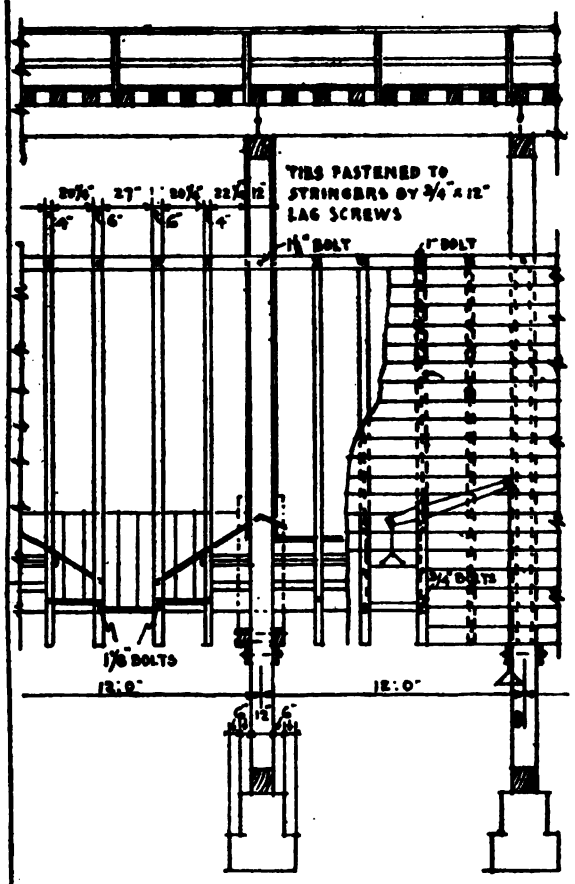
USE 3-8"x16" STRINGERS UNDER EACH RAIL

FOR 12'-0" OR 14'-0" SPANS

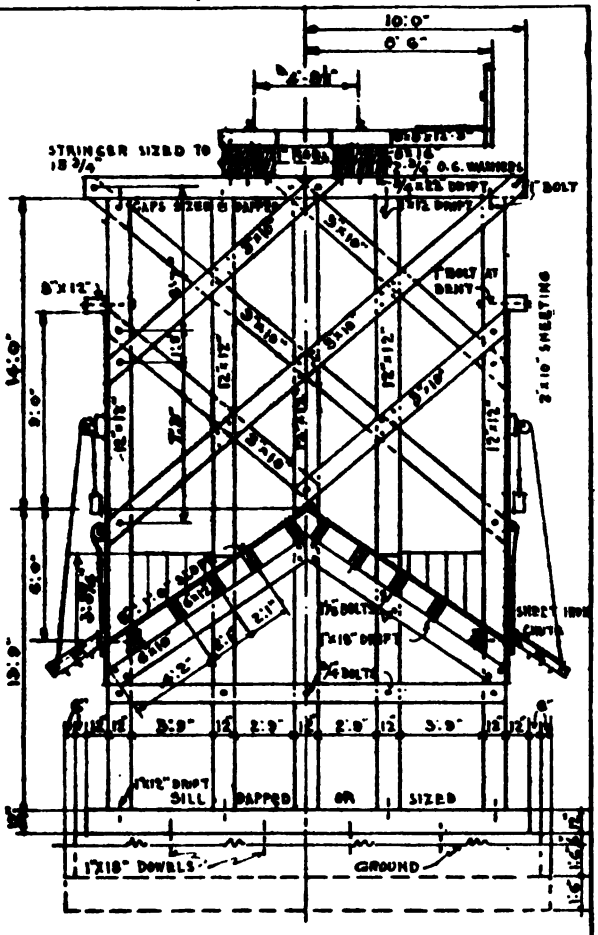
FOR ORIGINAL SEE DRAWING 617-24

CONSTRUCTION DIVISION OF THE ARMY

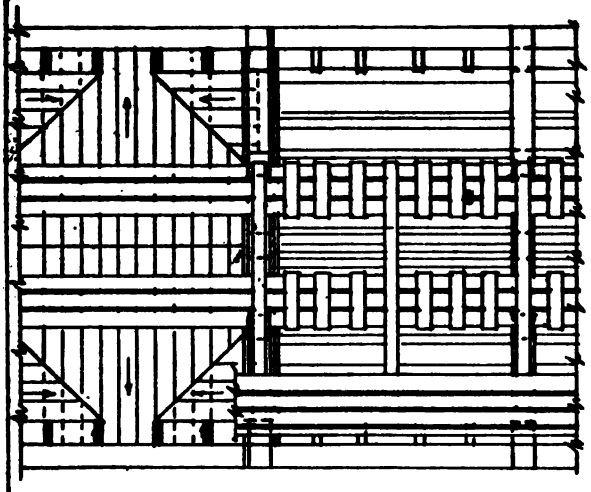
STANDARD RAILWAY COAL TRESTLE



SIDE ELEVATION



SECTION & ELEVATION



PLAN

CAPACITY:-10.0TONS PER. FT.

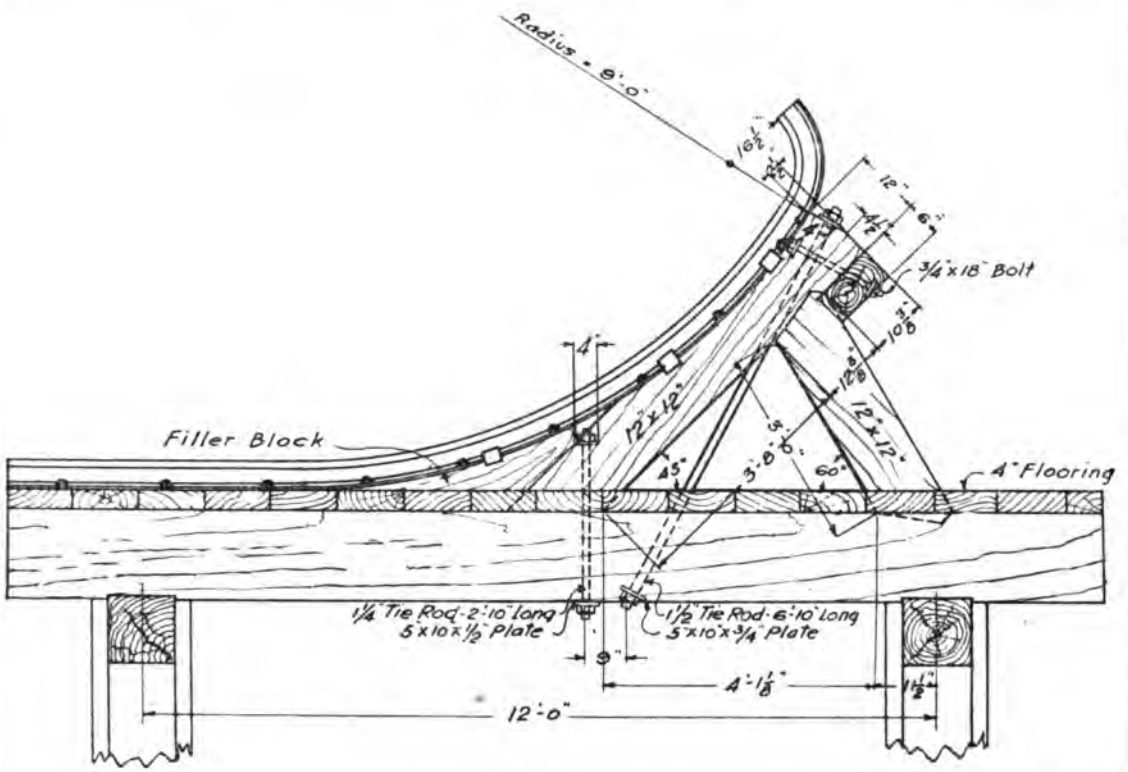
USE OGEE WASHERS FOR ALL BOLTS

FOR ORIGINAL SEE DRAWING 617:-25

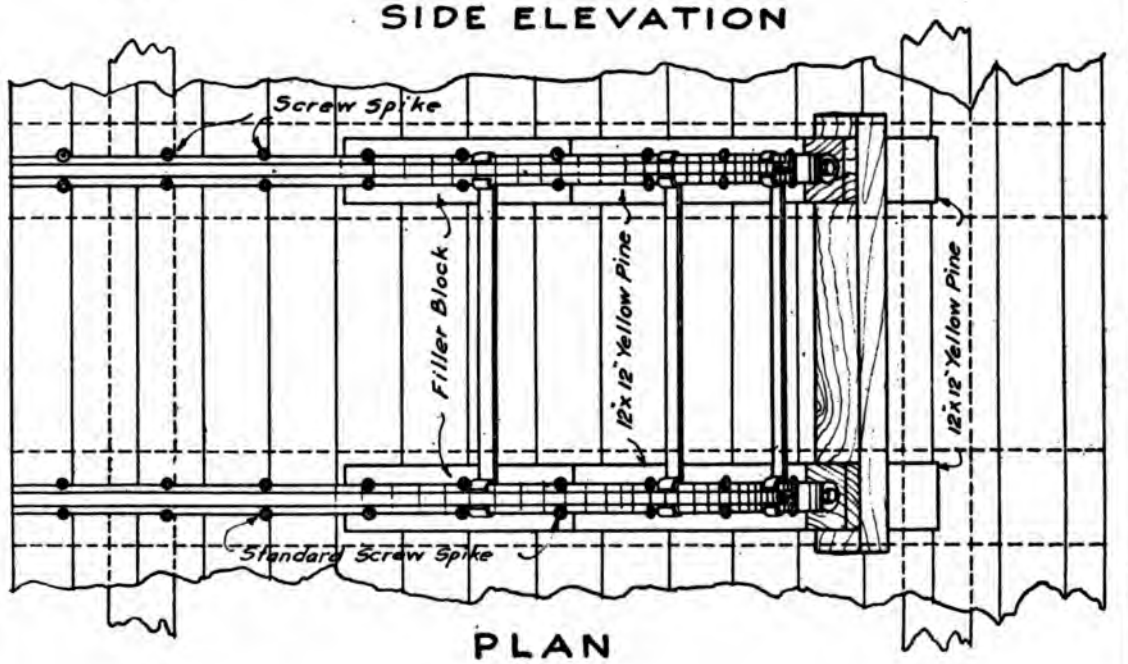
CONSTRUCTION DIVISION OF THE ARMY

STANDARD TIMBER COAL POCKET RAILROAD PLAN

CONSTRUCTION DIVISION OF THE ARMY.
No.8. TURNOUT AND CROSSOVER RAILWAYS



SIDE ELEVATION



PLAN

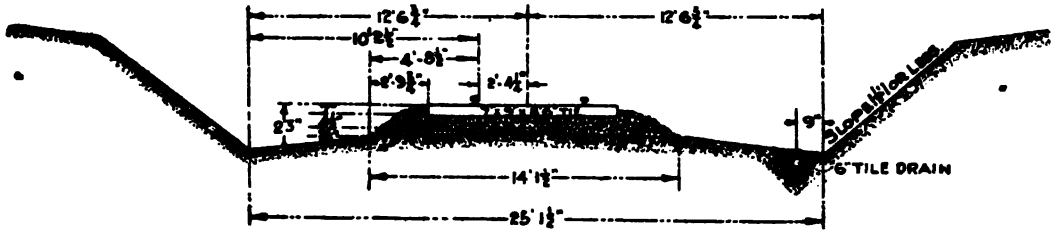
CONSTRUCTION DIVISION OF THE ARMY

STANDARD TRESTLE BUMPER

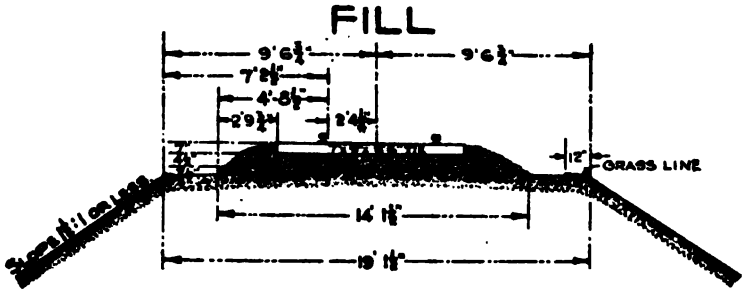
RAILWAYS

SINGLE TRACK ROADBED SECTIONS

CUT

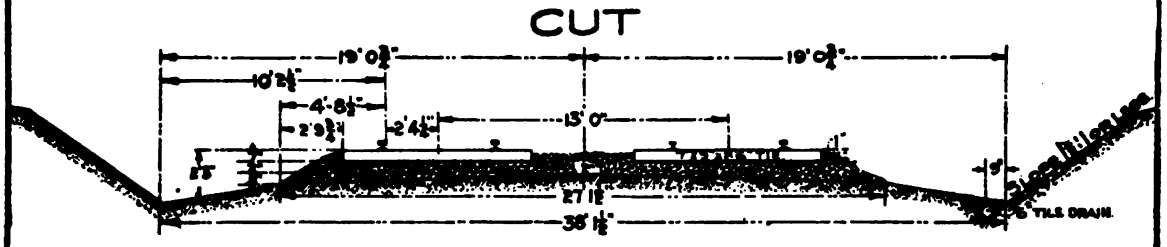


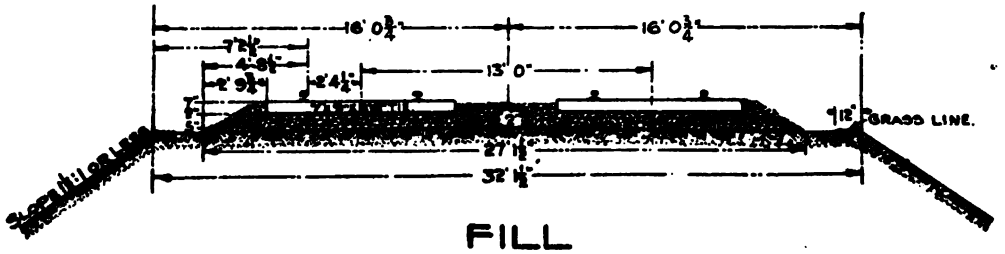
FILL



DOUBLE TRACK ROADBED SECTIONS

CUT





FILL

CONSTRUCTION DIVISION OF THE ARMY
ROADBED SECTIONS
RAILWAYS

left clear of obstruction and should be widened at the lower end sufficiently to prevent erosion of adjoining embankments.

SHRINKAGE.

In the forming of embankments provision should be made for shrinkage. As embankments become consolidated their sides should be carefully trimmed to the proper slopes.

CULVERTS.

The location, sizes and types of culverts will be indicated on general plan showing the layout of railroad track.

BALLAST.

Ballast should be placed as shown on roadbed sections, Plate 27. Bank gravel may be used for ballast, but if it contains more than three per cent dust or sixty per cent sand, it should be washed or screened. Washed or screened gravel should not contain less than twenty-five per cent nor more than fifty per cent sand. Material for ballast should pass through a two and one-half inch ring and be retained upon a No. 10 screen. Sand should pass through a No. 10 screen and be retained upon a No. 60 screen.

TIES

For ties, yellow pine or chestnut are preferred. Cross-ties should be well and smoothly hewn or sawed from straight growing timber and should be of specified dimensions and out of wind. Cross-ties should be of sound timber and free of bark. They should have sawed ends and straight parallel faces not less than 8 inches in width. They should not be less than 6 inches thick, nor less than 8 feet 6 inches long. A variation in size of ½ inch over in thickness, 2 inches over in width and 1 inch over in length may be permitted. Cross-ties should be uniformly spaced at a distance of 21 inches from center to center.

SWITCH TIMBERS.

All timber used for turnouts should be of yellow pine or equivalent, sawed to size as shown on standard drawing of turnouts.

RAILS.

The weight of rails should be eighty pounds per yard, sections Type "B," A. R. A., made and rolled in accordance with standard U. S. Government specifications for this rail.

FROGS, SWITCHES, JOINTS.

All frogs, switches, tie-plates, angle-joints and track fastenings should be of a type suitable to connect with the rails used.

SPIKES.

Standard railroad spikes are to be used and are to be 5½ inches long by 9/16 inch in dimensions. They should be free from burrs and rough edges and should have well-shaped heads and sharp points.

TRACK LAYING.

The track should be laid true to line and surface and of finished section similar to that shown. There should be at least six inches of gravel ballast under each tie. The ballast should be tamped solid from a point fifteen inches inside of rail to the end of tie. Ballast under center of tie should be loosely tamped. The ballast should be shaped as shown on the roadbed cross-section, Plate 27. Super-elevation of outer rail on curves should be made as required by conditions. Rail joints should not occur directly over a tie, but ties should be spaced an equal distance each side of the joints. Rail joints on each side of the track should be staggered so that the joint on one side may occur opposite the center of the rail on the other side.

CROSSING.

Wherever the railroad crosses a road or highway, a suitable crossing, similar to type shown on general plan, should be constructed.

WATER SUPPLY

PRELIMINARY NOTES.

These instructions are not to be considered as adequate specifications for materials to be furnished or for work to be done under the lump sum form of contract. They are intended to serve in connection with the emergency form of contract, to enable work in the field to proceed immediately without the necessity of waiting for detailed drawings.

Detailed specifications for use in connection with lump sum contracts will be furnished from the Washington Office on request.

General plans will be furnished from the Washington Office showing the layout of the distribution system of mains and service pipes. While the general location of the several units is subject to change, to suit the topography of the various camps, the layout of the water mains in each unit should be adhered to as closely as possible, as the entire layout of all of the service pipes for each unit, and the purchase orders for the pipes and fittings, are based on locating the water mains as shown on the drawings.

Standard symbols for water pipe lines and appurtenances, Plate 32A, should be used in all field drawings.

Experience in construction and operation of the cantonments has resulted in developing some new and improved methods in water supply construction. Among the features herein included may be mentioned:

(a) The looping and gating of piping connections at pumping stations and reservoirs.

(b) The avoidance of dead ends.

(c) The economical adjustment of the volume of storage, whether surface storage or elevated storage, to the pumping capacity, to the average rate of daily consumption and to the peak rates.

(d) The value of the location of elevated storage as affecting the efficiency of the distribution system.

QUALITY.

The water delivered through the distribution system should be clear and free from sediment. It should not contain objectionable quantities of iron, manganese or other mineral constituents. Above all, it must be absolutely safe from a sanitary standpoint. During the construction period great care must be taken that the water supply shall be maintained, at all times, in a safe and sanitary condition. See regulations concerning camp sanitation during construction.

QUANTITY.

The general specifications as to the quantity of water necessary, as hereinafter given, are based on the assumption that certain administration rules for the purpose of checking waste will be strictly enforced with the limitation of military requirements, as follows:

(a) All fixtures shall be shut off when not in actual use.

(b) The fire drill regulations shall make it the definite duty of certain designated individuals to shut off, as soon as fire alarm is sounded, every fixture from which water may be drawn for purposes other than fire fighting, excepting those necessary for cooking purposes.

(c) The several major units or groups shall make use of the showers at different hours, so that the very heavy peak load resulting from the simultaneous use of all the showers may be avoided.

(d) The use of water for sprinkling roadways and grounds, and for animals, shall be so timed as not to coincide with the peaks resulting from the heavy draught for the showers.

Failure to enforce such rules will render inadequate all of the principal component parts of the entire water supply, fire protection and sewerage systems and will be dangerous in case of fire. The systems as designed are of ample capacity for all legitimate uses.

Provision must be made to deliver water at the Government Reservation at a rate of at least 55 gallons per day for each man supplied. For example, for a cantonment of 36,000 men, the daily supply should be not less than 2,000,000 gallons, equivalent to about 1,400 gallons per minute; and for a cantonment of 45,000 men, the supply should be not less than 2,500,000 gallons per 24 hours, equivalent to about 1,750 gallons per minute.

Provision must be made at the Government Reservation, either through storage or otherwise, to furnish water to the distribution mains on three minutes' notice, and for a period of one hour, at rates 2.85 times as great as those just above specified; that is to say, at a rate of 4,000 gallons per minute, for one hour, for a cantonment of 36,000 men, and at a rate of 5,000 gallons per minute, for one hour, for a cantonment of 45,000 men.

The foregoing rates are intended in each case to include the water supply required for horses and mules and for sprinkling and miscellaneous uses.

PRESSURE.

The water should enter the distribution mains at a pressure of not less than 60, nor more than about 85 lbs. per square inch. In cantonments of less than 40,000 men, where the site is fairly level, and where no buildings occupy ground much higher than the point at which the water enters the distribution mains, pressure not greatly in excess of 60 lbs. will be sufficient. When, however, the cantonment houses more than 40,000 men; or when some of the buildings are on higher ground than the point at which the water enters the distribution system, higher

pressures will be necessary in order to give proper domestic and fire service. These pressures are limited to about 85 lbs. because of the use of wood stave pipe, most of which is designed for working pressures of about that amount.

MATERIALS.

All water works materials required by the general drawings will be scheduled by the office of the Advisory Engineer for Water Supply, for purchase by the Procurement Division.

These materials will include the service pipes and fittings up to within five (5) feet of the buildings which they supply, at which point the service pipe will terminate in a male pipe thread, the pipe from that point into the building being classed as plumbing.

WOOD STAVE PIPE.

Because of restrictions on the use of iron and steel, and for the sake of speed and economy, it is necessary to use wood stave pipe for distribution mains, to the extent that it may be possible to secure this pipe within the time available. This pipe should, except where otherwise specified, be of the machine-banded type, so that the pipe may be shipped already made up.

All machine-banded wood stave pipe should be of the best quality of redwood or fir, preferably air-dried redwood, wound for 200 feet head, and laid under the direct supervision of a competent pipe foreman, to be designated by the maker of the pipe, whose services and expenses under a lump sum contract should be paid for by the contractor. No concrete should be laid against any wood stave pipe. All special castings on wood stave mains must be the standard special castings suitable for use with Class B bell and spigot pipe. American Water Works Association Specification.

The joints between wood stave pipe and the bell and spigot pipe, or specials, are to be made in accordance with Plate 28. The cast iron plugs to be used in making these connections will be scheduled with the other water work materials for the job.

DEFLECTIONS AND INTERSECTIONS.

Wherever it is necessary to make a deflection of 90 degrees in the line of any wood stave pipe, this should be done with two 45 degree bends rather than with one 90 degree bend, lengths of cast iron pipe being inserted in the line as shown on Plate 29. Wherever a 45 degree deflection is necessary the 45 degree bend should have a sleeve on its spigot end, and there should be one length of cast iron pipe in the line on each side of the bend.

The use of crosses should be avoided, as crosses are more likely to be defective than tees, and a failure in a cross will put all four lines out of service. The proper method of making intersections is shown on Plate 29.

LEAD JOINTS.

Lead joints between bell and spigot cast iron pipe and specials, should be made by centering the spigot end within the bell after the spigot has been driven home, and yarning the joint with jute, closely compacted, so as to leave a depth of 2 inches for the lead. Each lead joint should be made with one continuous pouring from the ladle, should be poured full and thoroughly caulked at least three times around, with caulking tools of proper width.

SERVICE PIPES.

Where the distribution mains are of redwood pipe, all wrought steel service pipe should be connected to the mains by means of saddles and corporation cocks, and when necessary by reducing couplings. Great care must be taken to see that the saddles are tapped to fit the thread on the inlet side of the corporation cocks which are to be installed. The saddles should be wound on to the wood stave pipe when the pipe is manufactured. Short lengths of wood stave pipe with these saddles wound on may be purchased from the manufacturers of the pipe. Great care must be taken to set the outlets of the saddles directly horizontal, so that there will be no straining or bending of the pipes or fittings when the service pipe is connected up.

Where fir pipe is used the staves will be thick enough to permit the corporation cocks to be screwed directly into the main, and no saddles will be necessary, but the inlet side of the corporation cock must have wood pipe thread.

Wherever possible, bore hole in the wood stave pipe and insert the corporation cock before laying pipe in trench, as splintering inner edge of hole may thus be avoided and augur cuttings may be easily removed from pipe.

For 2-inch service pipe, the stop-cocks are to be 1¼-inch inlet and 1½-inch outlet and must be connected to the service pipe by 1½-inch by 2-inch reducing couplings. For 1½-inch service pipes, the stop-cocks are to have one-inch inlet and one-inch outlet and must be connected to service pipe by one-inch to 1½-inch reducing coupling. For one-inch service pipes the stop-cocks are to have ¾-inch inlet and one-inch outlet, no reducing coupling being necessary.

Except where otherwise specified, no stop-boxes are to be set over the corporation cocks, but great care must be taken to see that the latter are left wide open when the work hereunder is completed.

The methods of connecting services to mains and of frost-proofing service pipes under buildings, are shown on Plate 30.

GATE VALVES.

Gate valves should be set with standard extension valve boxes of length suitable to the depth of cover, the top of valve box being protected by a slab of concrete, as shown on Plate 31.

Gates may be of either the solid wedge or double disc type, and should close tight with the pressure on either side of the gate.

Gates should be tested at 300 pounds hydrostatic pressure and be suitable for 150 pounds working pressure.

Gates should be of the inside-screw type. The threaded stem should be of non-corrodible metal of suitable quality and size, and, after passing through the stuffing box, should be surmounted by a wrench but, 1 15/16 inches square at the top, 2 inches square at the bottom and 1¾ inches high, with a flange base upon which there should be cast an arrow showing the direction of opening and the word "OPEN."

All valves should open to the left (counter clockwise).

All gate, seat rings and stem nuts should be of non-corrodible material.

The gate valves should have iron bodies and such bronze mountings, in addition to those already specified, as the manufacturers customarily provide for the proposed service.

The valves should have hub ends, the bells of which should conform to the standards of the American Water Works Association for the several sizes of valves ordered.

FIRE HYDRANTS.

Hydrants should be connected to wood stave mains by means of tees or reducers, with short cast iron nipples 2 feet 2 inches long, as shown on Plate 31.

Hydrants are to be of the post type, with barrel of suitable length so as to provide over the branch pipe the cover specified for the several cantonments.

Hydrants must be fitted with bell end to fit American Water Works standard 4-inch pipe.

Hydrants should be designed to withstand a working pressure of 150 pounds, with a factor of safety of at least five.

The valve shut must remain tight if upper portion of barrel is broken off.

A positively operating, non-corrodible drip valve must be provided and arranged so as to drain the hydrant when the main valve is shut, the drip closing when hydrant is open.

The operating nut should be of pentagonal shape, finished with slight taper to 1½ inch from point to flat.

Hydrants should have 2½-inch hose outlets.

Hose nipples must be of composition metal and should preferably be threaded with fine thread into the hydrant, although the leading-in of nipple will be permited if suitable locking device is provided to prevent the pulling out of the nipple.

Hose threads on all nipples should conform to the "National Standard" 2½-inch thread. which is a 60 degree V thread, outside dianeter on male thread 3 and 1/16 inches and 7½ threads per inch.

Hose caps must be provided for all hose outlets and must be securely chained to the barrel.

The hose cap nut must be of the same size and shape as the operating nut.

The word "OPEN" and an arrow to indicate the direction to open shall be cast in raised letters on the hydrant top.

All hydrants shall open to the left (counter clockwise).

Design, materials and workmanship shall be similar to, and of as good quality as found in the latest stock pattern ordinarily produced by the manufacturers.

Hydrants shall be of such design that when delivering 500 gallons a minute the combined friction loss in pot, barrel and outlets shall not exceed three pounds.

Hydrant wrenches should be as shown on Plate 30.

Where necessary to protect fire hydrants against traffic, observe method shown on Plate 30.

TRENCHES AND PIPE LAYING.

Trenches for distribution mains and service pipe should be of such depth as will provide over the top of the barrel of the pipe, sufficient cover to prevent freezing in mains or service pipes, this cover in no case to be less than 2 feet, which is the minimum depth necessary to protect the pipes from injury by traffic. No water pipe should occupy the same trench with any sewer pipe, gas pipe or other pipe, drain, or conduit. The trench should be so dug and trimmed that the pipe can be laid without abrupt changes in grade, and as nearly straight horizontally as may be economically practicable; and the bottom of the trench should be so surfaced that the minimum amount of filling will be required to bed the pipe for its entire length.

The bottom width of the trench should be sufficient to permit laying the pipe in the best possible manner, and should be at least one foot in excess of the outer diameter of the pipe. Bell holes of sufficient size to permit pouring and caulking lead joints should be excavated wherever such joints have to be poured and caulked in the trench.

TESTS OF WOOD STAVE PIPE.

Only sufficient earth should be placed about wood stave pipe to brace and bed it preliminary to the pressure test and to keep the pipe from floating up, in case the trench should be filled with water. The ends of the collars and fittings should be kept free so that they may be caulked or wedged if necessary. Under no circumstances should the trench for wood stave pipe be back filled to a greater extent than that just specified, until the pipe line has been filled with water for at least three days, under a head not to exceed that due to water standing up to the nozzles of the highest hydrant on the section being tested, at the end of which time it should be subjected to a hydrostatic test under a head of 200 feet for two days. While the pipe is under this test pressure, all leaks should be made tight by caulking, wedging or otherwise.

After the pipe has been thus made tight, the back filling of the trench should be finished. After the barrel of the pipe has been thoroughly bedded and covered to a depth of at least one foot, the back filling should be thoroughly compacted either by tamping or puddling or both, according to the nature of the excavated soil. Service pipes should be tested and made tight under full head of 200 feet before trenches are back filled, the end of the service pipe being temporarily capped, if necessary, for the test.

RESERVOIRS OR TANKS.

The high price of labor, restrictions on the use of steel and iron, and the necessity for rapid construction in war time, make it advisable in the majority of instances to use tanks of air-dried redwood lumber, instead of concrete reservoirs or steel tanks. The staves, bottoms and bands of these redwood tanks can usually be shipped within a few hours from receipt of order, from the mills in California. Arrangements should be made in every case to secure from the makers the service of an expert tank foreman to superintend the erection of the tank, as unless this is done the makers will not guarantee the water-tightness of the tank. Tanks must in every instance be covered.

Detail drawings for foundations, roofs, and towers, if necessary, will be furnished on request by the makers of the tank. Lumber for the roofs, towers or grillage need not be redwood, but should be purchased in the same manner as lumber for other structures on the Government reservation.

As the cost of wooden towers under wooden tanks increases very rapidly with the height of the tower, no such tower should be more than 40 feet high and, whenever possible, the height of such towers should be kept below 30 feet.

PUMPING EQUIPMENT.

The pumping unit for general service is usually a direct-connected, electric-motor-driven centrifugal pump; and three or more such units should, in most cases, be provided.

As a reserve against failure in the supply of electric current, at least one pump driven by an internal combustion engine should be installed, the fuel being gasoline for units which will be run only at rare intervals, and fuel oil when the unit may be expected to be used for any considerable proportion of the time.

It is not intended that the aggregate capacity of the internal combustion engine units shall equal the aggregate capacity of the electric-driven units, as the former will generally be used only to tide over relatively short periods of emergency, during which a more economical use of water should be enforced.

PIPING AT PUMPING STATION AND RESERVOIRS.

A typical diagramatic layout of the pipe, valves and fittings at pumping stations and reservoirs is shown on Plate 32. This layout is designed to afford the maximum reliability of service. It will be noted that it would not be possible for a failure in any one pipe or casting to disable more than one pumping unit at a time, or for failure in any one valve to disable more than two pumping units at a time.

The proper method of setting altitude control valves, and other valves and fittings, on connections to reservoirs is shown on Plate 29.

PAINTING WATER PIPES.

Water pipes should be identified by means of bands painted thereon. The bands should be four inches wide and are to be located near valves or joints. The colors to be used are "Red" for *fire lines* and "Green" for all other *water lines.* Wherever practicable the plant engineer should be consulted as to location of bands.

LEAD JOINT FOR CONNECTING REDWOOD OR FIR STAVE PIPE TO CAST IRON PIPE, VALVES, OR FITTINGS

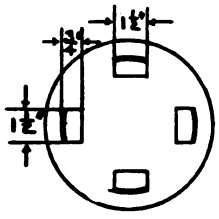


FIG. 1

BOTTOM VIEW OF PLUG SHOWING RECESSES IN ¾" EXTENSION TO ACCOMMODATE THE LUGS ON VALVE SEATS.

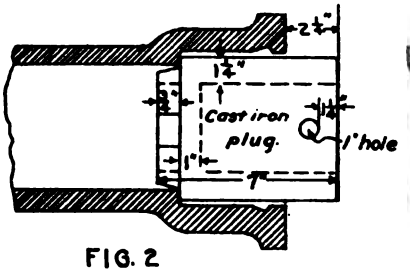


FIG. 2

DIAGRAM OF CAST IRON BELL BEFORE POURING LEAD JOINT SHOWING PLUG IN PLACE.

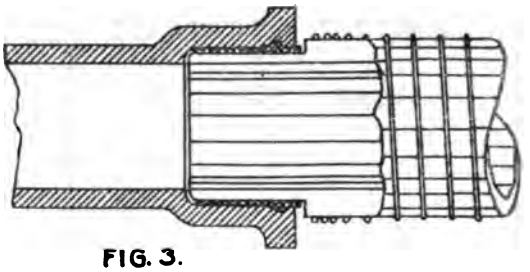


FIG. 3.

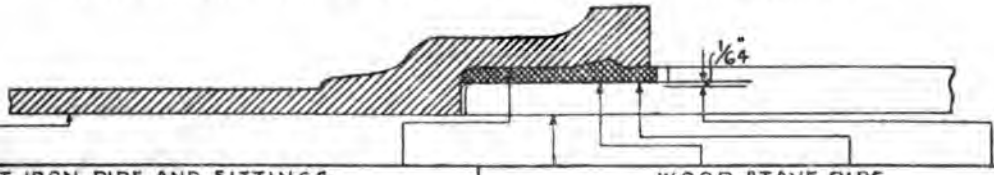
DIAGRAM SHOWING LEAD JOINT BETWEEN WOOD STAVE PIPE AND CAST IRON PIPE OR FITTINGS.

TO MAKE JOINT

INSERT PLUG IN BELL AS SHOWN IN FIG. 2.
POUR LEAD JOINT AND CAULK LIGHTLY TO ENSURE TIGHT JOINT BETWEEN LEAD AND INSIDE OF BELL.
REMOVE PLUG, LEAVING LEAD IN BELL.
DRIVE TENON OF WOOD STAVE PIPE INTO BELL AS SHOWN IN FIG. 3.
CAULK LEAD JOINT LIGHTLY IF NECESSARY.
TENON MAY BE BRUSHED WITH THIN SOFT SOAP JUST BEFORE INSERTING IN JOINT
PLUG IS TO BE SMOOTHLY TURNED WITH TAPER OF 1/16" IN 4". OUTSIDE DIAMETER OF PLUG AT FACE OF BELL IS TO BE ½" LESS THAN OUTSIDE DIAMETER OF TENON OF WOOD STAVE PIPE. OUTSIDE DIAMETER OF PLUG AT BOTTOM OF BELL IS TO BE 1/16" LESS THAN OUTSIDE DIAMETER OF PLUG AT FACE OF BELL.
WHEREVER IT IS POSSIBLE TO DO SO, IT WILL BE FOUND MORE CONVENIENT TO POUR THE LEAD AND REMOVE PLUG BEFORE PLACING THE CAST IRON PIPE OR FITTING IN THE TRENCH.

TABLE OF SIZES FOR CAST IRON PIPE-REDWOOD OR FIR STAVE PIPE & FITTINGS.

AMERICAN WATER WORKS ASSOCIATION STANDARD



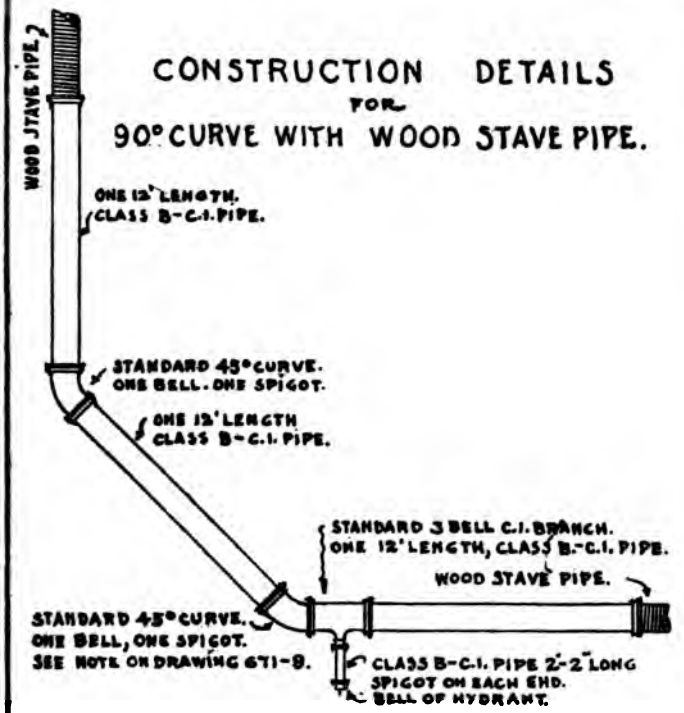
CAST IRON PIPE AND FITTINGS.				WOOD STAVE PIPE			
NOMINAL DIAMETER	CLASS PIPE	CLASS FITTINGS	MINIMUM I.D. BELL	INSIDE DIAM. WOOD PIPE	OUTSIDE DIAM TENON	MIN. THICK'S OF LEAD	O.D. PLUG AT FACE OF BELL
4"	BCD	BCD	5.70"	4"	5 7/16"	0.145"	5 13/32"
6"	"	"	7.80	6"	7 1/2"	0.165"	7 15/32"
8"	CD	ABCD	10.00	8"	9 3/4"	0.140"	9 23/32"
10"	"	"	12.10	10"	11 5/16"	0.255"	11 19/32"
12"	ABCD	"	14.00	12"	13 3/4"	0.140"	13 25/32"
14"	"	"	16.10	14"	15 3/4"	0.175"	15 23/32"
16"	"	"	18.40	16"	18"	0.220"	17 29/32"
18"	"	"	20.50	18"	20"	0.270"	19 31/32"
20"	"	"	22.60	20"	22"	0.320"	21 31/32"
24"	"	"	26.80	24"	26"	0.420"	25 31/32"

CONSTRUCTION DIVISION OF THE ARMY

LEAD JOINT

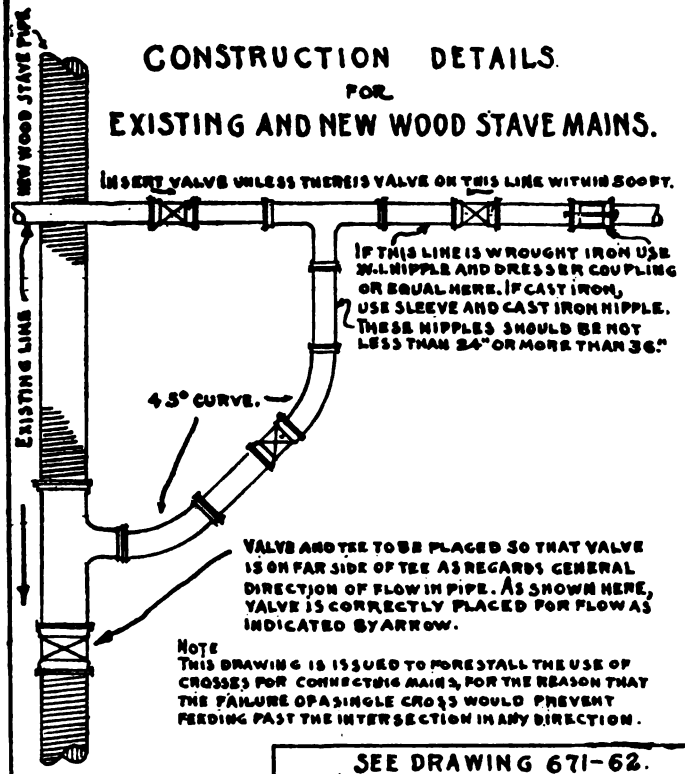
CONNECTING REDWOOD OR FIR STAVE PIPE TO CAST IRON PIPE, VALVES OR FITTINGS

CONSTRUCTION DETAILS FOR 90° CURVE WITH WOOD STAVE PIPE.


WOOD STAVE PIPE.
ONE 12' LENGTH. CLASS B-C.I. PIPE.
STANDARD 45° CURVE. ONE BELL. ONE SPIGOT.
ONE 12' LENGTH CLASS B-C.I. PIPE.
STANDARD 3 BELL C.I. BRANCH. ONE 12' LENGTH, CLASS B-C.I. PIPE.
WOOD STAVE PIPE.
STANDARD 45° CURVE. ONE BELL, ONE SPIGOT. SEE NOTE ON DRAWING 671-9.
CLASS B-C.I. PIPE 2'-2" LONG SPIGOT ON EACH END. BELL OF HYDRANT.

SEE DRAWING 671-51.

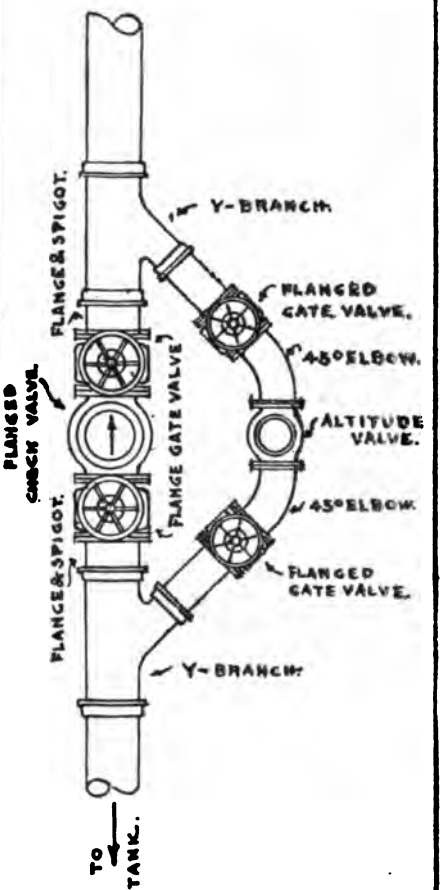
CONSTRUCTION DETAILS FOR EXISTING AND NEW WOOD STAVE MAINS.


NEW WOOD STAVE PIPE.
INSERT VALVE UNLESS THERE IS VALVE ON THIS LINE WITHIN 500 FT.
IF THIS LINE IS WROUGHT IRON USE W.I. NIPPLE AND DRESSER COUPLING OR EQUAL HERE. IF CAST IRON, USE SLEEVE AND CAST IRON NIPPLE. THESE NIPPLES SHOULD BE NOT LESS THAN 24" OR MORE THAN 36."
EXISTING LINE
45° CURVE.
VALVE AND TEE TO BE PLACED SO THAT VALVE IS ON FAR SIDE OF TEE AS REGARDS GENERAL DIRECTION OF FLOW IN PIPE. AS SHOWN HERE, VALVE IS CORRECTLY PLACED FOR FLOW AS INDICATED BY ARROW.

NOTE
THIS DRAWING IS ISSUED TO FORESTALL THE USE OF CROSSES FOR CONNECTING MAINS, FOR THE REASON THAT THE FAILURE OF A SINGLE CROSS WOULD PREVENT FEEDING PAST THE INTERSECTION IN ANY DIRECTION.

SEE DRAWING 671-62.

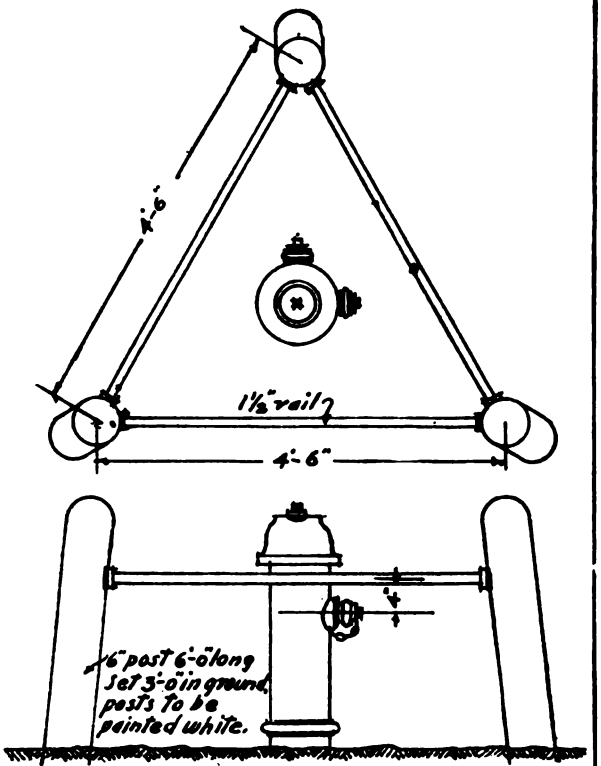
STANDARD SETTING FOR ALTITUDE VALVE.



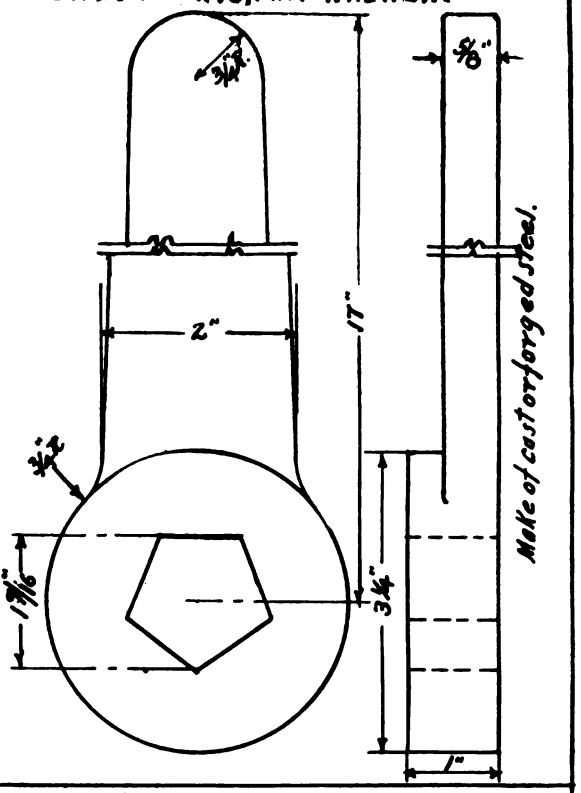
SEE DRAWING 610-213.

CONSTRUCTION DIVISION OF THE ARMY
DETAILS
90° CURVE WITH WOOD STAVE PIPE-EXISTING & NEW WOOD STAVE MAINS-STANDARD SETTING FOR ALT. VALVE

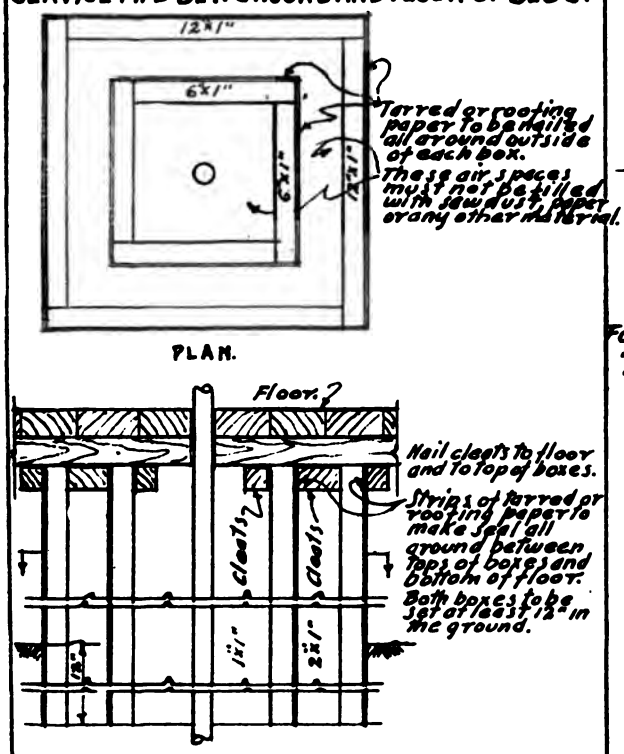
STANDARD PROTECTION FOR FIRE HYDRANT.



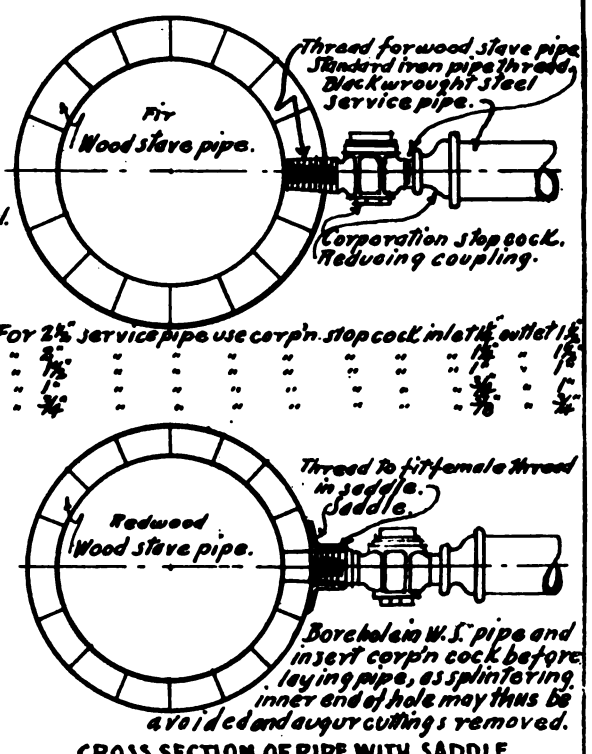
STANDARD HYDRANT WRENCH.



FROST PROOFING FOR VERTICAL PORTION OF SERVICE PIPE BET. GROUND AND FLOOR OF BLD'G.


12"x1"
6"x1"
Tarred or roofing paper to be nailed all around outside of each box.
These air spaces must not be filled with sawdust, paper or any other material.
PLAN.
Floor.
Nail cleats to floor and to top of boxes.
Strips of tarred or roofing paper to make seal all around between tops of boxes and bottom of floor.
Both boxes to be set at least 12" in the ground.

CONNECTING SERVICE PIPE TO MAINS.


Thread for wood stave pipe. Standard iron pipe thread. Black wrought steel service pipe.
Fir
Wood stave pipe.
Corporation stop cock. Reducing coupling.
For 2½" service pipe use corp'n. stop cock inlet 1½" outlet 1½"
" 2" " " " " " " 1" " 1"
" 1½" " " " " " " ¾" " ¾"
" 1" " " " " " " ½" " ½"
" ¾" " " " " " " ⅜" " ⅜"

Thread to fit female thread in saddle.
Saddle.
Redwood
Wood stave pipe.
Bore hole in W.S. pipe and insert corp'n cock before laying pipe, as splintering inner end of hole may thus be avoided and augur cuttings removed.

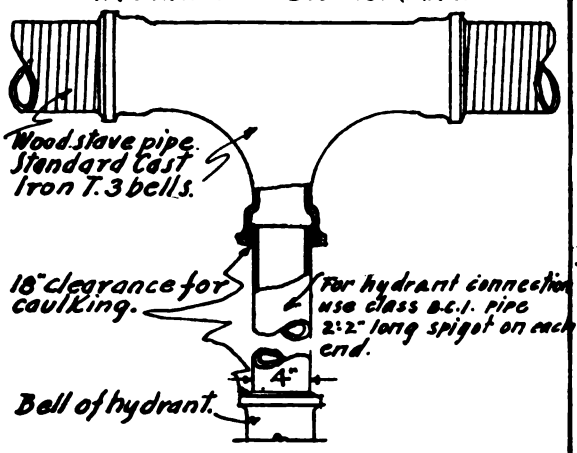
CROSS SECTION OF PIPE WITH SADDLE.

CONSTRUCTION DIVISION OF THE ARMY

DETAILS

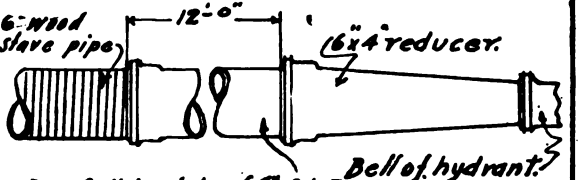
STANDARD DETAILS OF PROTECTION FOR FIRE HYDRANTS—HYDRANT WRENCH CONNECTING SERVICE PIPE TO WOOD MAIN- FROST PROOFING FOR VERTICAL PORTION OF SERVICE PIPE BETWEEN GROUND & FLOOR OF BUILDING.

DETAILS FOR CONNECTING FIRE HYDRANT TO SIDE OF MAIN.


Wood stave pipe. Standard cast iron T. 3 bells.
18" clearance for caulking.
For hydrant connection use class B.C.I. pipe 2'-2" long spigot on each end.
4"
Bell of hydrant.

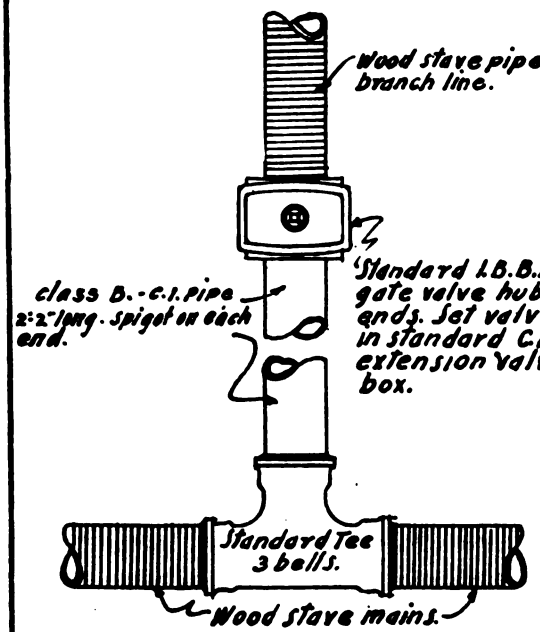
Hydrant to be of reputable make, to have valve opening at least 4" diam., and to discharge 500 G.P.M. with friction loss of not more than 31b. length of barrel to suit depth of cover required at cantonment.
If branch is longer than 2'-2" use C.I. pipe.

DETAILS FOR CONNECTING FIRE HYDRANT TO END OF 6" MAIN.

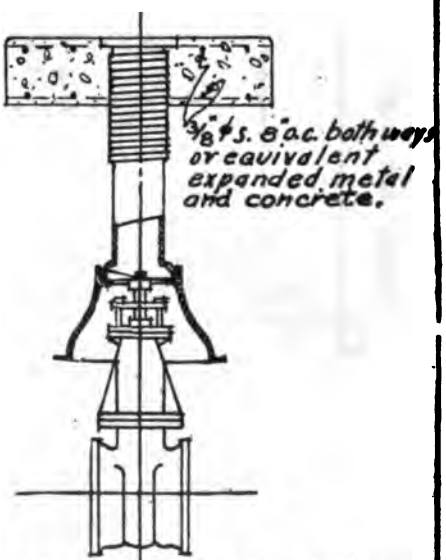


One full length of 6" C.I. B&S pipe. class B. A.W.W.A.

DETAILS FOR CONNECTING BRANCH LINES TO MAINS.


Wood stave pipe branch line.
Standard L.B.B.M. gate valve hub ends. Set valve in standard C.I. extension valve box.
class B.-C.I. pipe 2'-2" long. spigot on each end.
Standard Tee 3 bells.
Wood stave mains.

DETAILS FOR PROTECTING VALVES & VALVE BOXES.



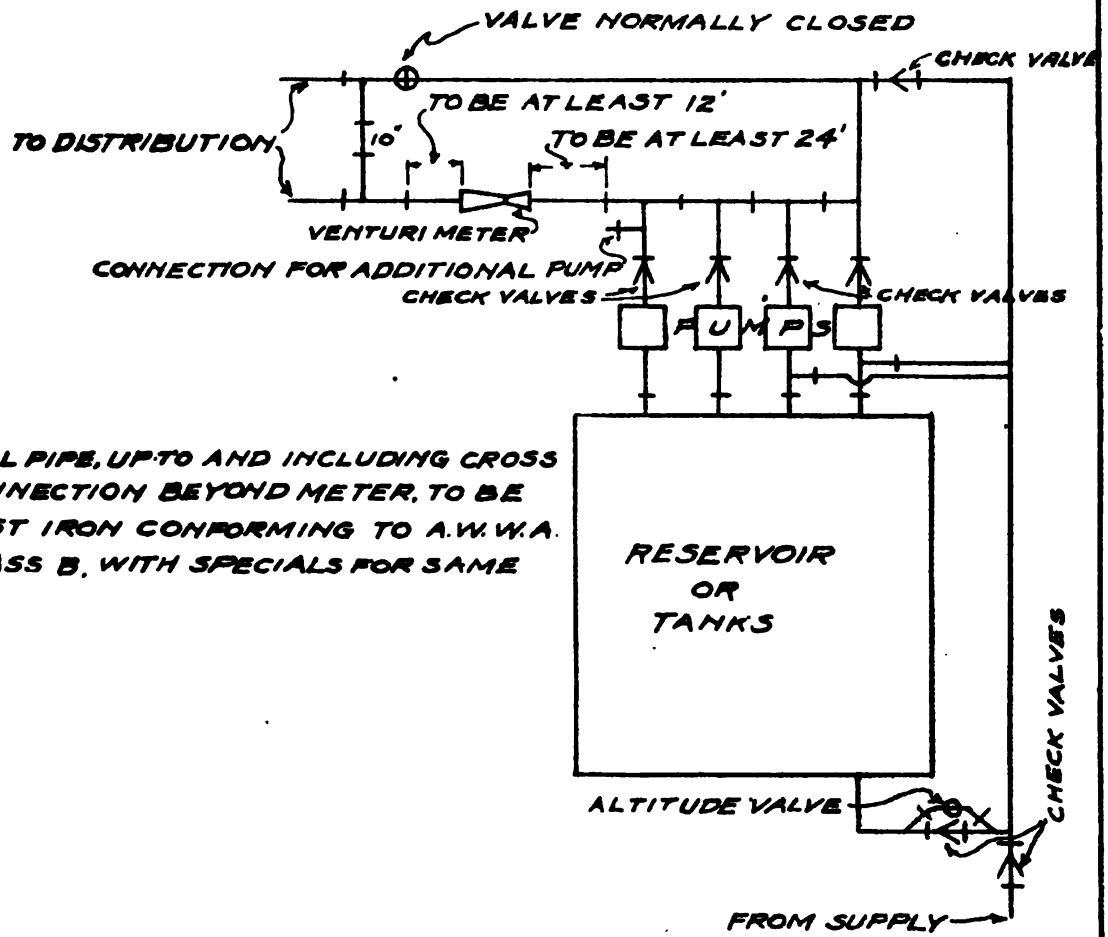
In setting valve box leave at least 4" between valve box and gate at nearest point. Cast around top of each valve box a 1-2½-5 concrete disc 3'-0" diam by 9" thick as shown.

CONSTRUCTION DIVISION OF THE ARMY
DETAILS
WOOD STAVE PIPE-BRANCH LINE VALVES AND VALVE BOXES

CONSTRUCTION DETAILS

FOR

TYPICAL LAYOUT OF PUMPS, RESERVOIR, TANKS, METER AND PIPE CONNECTIONS, FOR WATER SYSTEMS IN WHICH SUPPLY IS DELIVERED INTO STORAGE AND HAS TO BE PUMPED THENCE INTO THE DISTRIBUTION MAINS, AND WHERE THERE IS NO ELEVATED STORAGE ON DISTRIBUTION MAINS. WHERE THERE IS SUCH ELEVATED STORAGE, THE NUMBER OF PUMPING UNITS MAY BE REDUCED.



WHERE PUMPS DO NOT TAKE SUCTION UNDER HEAD, PROVIDE SUITABLE PRIMING APPLIANCES IN DUPLICATE.

WHERE EXCESSIVE PRESSURES MIGHT OTHERWISE COME ON MAINS AS THE RESULT OF SHUTTING OFF DRAUGHT WHILE PUMPS ARE RUNNING AT HIGH RATES, SUITABLE RELIEF VALVES SHOULD BE PROVIDED AT PUMPING STATION.

CONSTRUCTION DIVISION OF THE ARMY

TYPICAL ARRANGEMENT FOR PUMPING STATION.

Catch Basin — C.B.

Manhole — M.H.

Sump — SUMP

SEWER LINES EXISTING

Sanitary

Combined

Storm Water

SEWER LINES PROPOSED

Sanitary

Combined

Storm Water

WATER MAINS EXISTING

Main

Hydrant

Valve

Meter — M.

Riser — R.

WATER MAINS PROPOSED

Main

Hydrant

Valve

Post Indicator Valve — P.I.V.

Check Valve

Altitude Valve

CONSTRUCTION DIVISION OF THE ARMY

SEWER AND WATER LINES CONVENTIONAL SIGNS

PROVISIONS FOR FIRE PREVENTION.

PRELIMINARY.

These instructions have been prepared under the advice and with the co-operation of the National Board of Fire Underwriters, in order to minimize the danger of fire in building projects. The main features of the provisions contain such parts as may affect work under actual construction, as well as the design and equipment for emergency construction. For regulations as to *organization for fire protection, care and use of apparatus,* and *fire alarm,* reference should be made to full instructions of August 10, 1918, issued as Section F by the Construction Division of the Army.

CLEARING SITE.

1. Before the delivery of lumber and building material is begun, the site should be cleared. Shade trees should be retained, but all other trees, brush and grass should be cut and the site burned over. A clear space of 200 feet around the site and storage yards should be included in the burnt-over area.

LOCATION OF BUILDINGS.

2. Buildings should be kept well separated. This applies to temporary as well as to permanent buildings; 30 feet counts as a severe exposure with even one-story buildings, and to obtain good separation, 50 feet is necessary. All large buildings should be 100 feet apart. A fire break must be at least 300 feet wide.

STORAGE OF MATERIALS.

3. Lumber storage yards should be divided into sections containing not more than one hundred thousand feet, board measure, by clear spaces of 100 feet, with like space to any building. No lumber, refuse or loaded trucks should be left in these spaces at the close of a day's work.

(a) No lumber or roofing material should be placed within 15 feet of a building. No material should be piled so as to prevent access of fire apparatus to any building.

(b) The storage of the following materials should be segregated, and kept in detached buildings or shelters, each material by itself: Acids, calcium carbide, lime, dynamite, blasting caps, blasting powder, oakum, oils of all kinds, paints, hay and feed. Gasoline storage should be underground and pump located out doors. Oakum should not be stored where it will be exposed to the direct rays of the sun.

(c) Oil, disinfecting oils and mixed paints in barrels, should be stored from 50 to 150 feet from buildings, depending upon the quantity stored. This storage space should be located on the lowest ground of the vicinity.

LIGHTS AND WIRING.

4. All electric wiring, even for temporary use, should conform to the National Electrical Code.

(a) Alterations and extensions must be made only by electricians. The connecting of electric irons, stoves, or larger lamps other than shown on the plans, should be prohibited.

(b) Electric lights should, if possible, be installed in stables, making the use of lanterns unnecessary.

(c) The use of paper shades on electric lights, or hanging articles on electric wire, should be prohibited.

(d) The use of open flame lights, of gasoline or acetylene lights, lamps, or lanterns, lamps with glass reservoirs and large hanging center draft lamps, in buildings should be prohibited.

MACHINERY, BOILERS, ETC.

5. Power driven machinery should not be permitted in buildings under construction nor in large buildings used for storage.

(a) Gasoline engine-driven machines should be in open sheds or metal clad buildings, at least 20 feet from other buildings, and the exhaust pipes should be kept clear of all sawdust and woodwork.

(b) Boilers and oil engines should be installed in detached metal clad buildings. Boilers should not be set on wooden floors, frames, or platforms. The clearance should be at least three feet at side and at rear walls, five feet at front and below roof.

(c) The stack of a boiler into which exhaust from an engine is carried, should be screened or provided with a spark arrester. This applies particularly to switch engines operating on the site.

HEATING DEVICES, STOVES AND RANGES.

6. Gasoline furnaces and torches used by plumbers, tinsmiths, and electricians should be kept in outside tool boxes. When in use an attendant should be constantly present.

(a) Tinsmiths' pots using charcoal should not be permitted except in their own shops.

(b) Tar kettles, lead melting, and other furnaces using wood for fuel, should not be placed within 20 feet of buildings or lumber. Attendants must be constantly present and must extinguish all fire at the end of each day's work.

(c) Ranges in mess buildings should be set equally well for temporary or for permanent use. In no case should ranges be set on an unprotected wooden floor. Hearths of concrete, or brick and sand four or more inches deep, should be provided under the ranges and should extend all around same, 18 inches at front and 12 inches elsewhere. All woodwork within 18 inches of the sides or rear of the ranges should be protected by cellular asbestos covered with sheet metal or by sheet metal, set upon insulators, to extend two feet above the top of the ranges. A ventilating thimble should be provided for each smoke pipe, and all woodwork within one foot of the pipe protected with asbestos board.

(d) The use of kerosene stoves and heaters should be prohibited. Stoves should not be set on unprotected wooden floors, nor near wooden partitions. Floor protection should consist of a sheet metal plate, or asbestos board and a sheet metal plate, according to the size of the stove and its height above the floor. The floor plate should extend one foot beyond the stove on sides and rear, and 18 inches at front.

PAINTING.

7. Painters should have shops or shanties, completely separated from other buildings, where all paint should be mixed and all materials stored, such as paints, paint-pots, rags and painters' overalls.

(a) Only the quantity of oil or paint needed for one day's work should be taken into a building.

(b) Painters should be required to remove all paint, rags, paint refuse and overalls from the building at the end of each day's work.

(c) Oily waste and paint rags should be collected and burned daily. Self-closing waste cans should be provided where waste and rags are used.

RUBBISH.

8. All rubbish, building refuse and discarded material should be removed from, in and around buildings daily, and taken to a prescribed place for burning or storage. This should apply to sawdust and refuse at saw mills, as well as around buildings.

(a) All refuse material that is saved for fuel should be neatly piled in lots of not over 100 cords and at least 100 feet from all buildings.

(b) Strict attention should be given that refuse is not deposited beneath floors.

SMOKING.

9. Smoking should be prohibited in all parts of the site where building construction is in progress, and around stables, storehouses and lumber storage. Large printed, "No Smoking," signs should be posted.

(a) Certain areas may be defined where workmen are permitted to smoke during noon hours. In construction camps smoking may be permitted in buildings where constant watch is maintained.

MISCELLANEOUS.

10. Open fires, either for burning small amounts of rubbish or for warmth, must be prohibited on the building site or within 200 feet of lumber.

(a) The use of wooden boxes as cuspidors should be prohibited.

(b) Automobiles, trucks and motorcycles should not be parked within 15 feet of a building. No part of a building used for any other purpose should be used as a garage, unless cut off from the remainder of the building by a standard fire wall.

(c) Printed rules covering the parts of fire prevention and fire protection regulations which concern the general construction force, should be posted about the work.

STRUCTURAL FEATURES.

1. While features of construction are generally covered by the drawings, certain details should be considered in connection with fire protection; these should apply to temporary buildings as well as all others.

(a) *Roofing materials* should have some fire resistive qualities, such as Class C. Underwriters' Grade. This class includes good quality two-ply prepared roofing and is the minimum quality which should be used.

(b) *Boarding Down Building:* All buildings should be boarded down tight to the ground so that flying brands and sparks will not lodge beneath them. All openings into such spaces should be well screened.

(c) *Ventilators* in the roofs of buildings should be thoroughly screened to prevent the entrance of sparks or embers from a fire.

(d) *Ladders:* Permanent ladders should be attached to the outside of all frame buildings more than one story high. These should give access to the roof and be so placed as to serve as emergency exits from the upper floors.

(e) *Setting Stoves and Ranges:* See Art. 6-(c) and 6-(d) of this Section.

(f) *Concealed spaces:* As far as possible concealed spaces should not be created by sheathing or ceiling. Closets and lockers should be reduced to a minimum. Any concealed space formed between roof and ceiling, and between first floor level and grade, exceeding 3,000 square feet in area, should always be divided by tight partitions.

(g) *Brackets and Shelves for Fire Appliances:* Substantial brackets or shelves should be provided for all fire appliances.

EXISTING AVAILABLE FIRE PROTECTION.

1. Where construction work is to be performed, at an existing camp or post, the amount, location, kind and condition of all fire apparatus and appliances on hand should be ascertained. in order that the amount of additional appliances necessary for temporary and permanent fire protection may be determined. Where the site is adjacent to a municipality having a fire department, if such department can reach the site within twenty minutes, definite arrangements should be made for response.

2. Provision should be made for the response of the Post fire brigade where one exists.

FIRE APPARATUS AND APPLIANCES.

Note: All fire apparatus and appliances should conform to Army Standard Specifications.

TYPE, USE AND DISTRIBUTION.

(a) *Fire Pails:* These are particularly useful for temporary protection in connection with water barrels. They should be permanently installed in barracks, storehouses, garages and stables. One pail to each 400 square feet of floor area should be placed inside of buildings; outside, three should be placed at each barrel. In kitchens and garages they should be filled with fine dry sand; in other places they should be kept filled with clean water.

(b) *Water Barrels:* These should be installed for temporary protection of all building construction and lumber yards, and for permanent protection at storehouses, open sheds and open storages. They should be spaced not over 100 feet apart in each direction.

(c) Upon the approach of cold weather 50 pounds of salt should be dissolved in each water barrel to prevent freezing. Calcium chloride in proper proportion should be dissolved in hand pump tanks in place of salt for the same purpose.

(d) *Two and one-half-gallon extinguishers:* should be installed in all buildings, as soon as the roof is on, except where hand-pump tanks are used instead. This extinguisher is for general use, but should not be placed where it might be used on electrical installations, or where it is subject to freezing. One should be placed in each building of over 1,000 square feet area in the proportion of one to each 2,500 square feet of floor area.

(e) *One-quart carbon tetra-chloride extinguishers:* are for use on fires in connection with electrical machinery, oil or gasoline. These should be placed in kitchens for grease fires, in garages, in oil houses and on motor trucks. Not less than two extinguishers should be placed in a garage. They do not take the place of other appliances.

(f) *Hand Pump Tanks:* These may be used in place of two and one-half-gallon extinguishers in all buildings and should be distributed in the same manner. They are particularly useful for unheated buildings as a non-freezing solution may be used in them.

(g) *Hand Hose Carts:* These should be part of any fire protection system where a water supply with fire hydrants is available. They should be loaded with not over 500 feet of single jacketed cotton rubber lined hose. One hose cart should be located within 800 feet of every building within the area protected by the water system. Hand hose carts should be properly protected against weather in small buildings, as shown on drawing 671.7-102, in the files of the Construction Division.

(h) *Fire hose:* should be single jacketed cotton rubber lined, except that for standard pumping engines, which should be double-jacketed. These should have couplings with National Standard hose threads, unless the post hydrants have another thread, in which case, the hose couplings should conform to the thread of the existing post hydrants. Where standard pumping apparatus is provided, 1,000 feet of double-jacketed hose should be placed on each piece of apparatus and 1,000 feet kept in reserve.

(i) *Temporary and Emergency Equipment:* The following are suggestions which may be of use for temporary fire protection, depending on local conditions:

Horse-drawn apparatus may in some cases be borrowed from the nearest city fire department. An automobile truck may be fitted with a number of 2½-gallon extinguishers, hand-pump tanks, shovels, brooms, mattocks, and empty bags for fighting brush fires. These will probably be of particular service during the time the site is being cleared. Large tank wagons, when available, should be kept filled and arrangements should be made for getting them to fires. Locomotives are sometimes equipped with fire pumps and carry hose. These are particularly useful, and where a switch engine is needed on the work, one so equipped should be secured if possible.

PAINTING WATER PIPES

All water pipes should be identified by a four-inch painted band, located near each valve: "Red" for fire lines; "Green" for all other water lines.

SEWERS AND SEWAGE TREATMENT PLANTS.

PRELIMINARY NOTES.

The sewerage system is designed for removal of house sewage only. No surface drainage should be admitted thereto. No material changes should be made in designs furnished or approved by the Washington office, unless approval of such changes has been obtained from that office. The Constructing Officer is required to furnish the Washington office data and drawings showing completely any changes or deviations from the approved plans, so that these can be made part of the permanent records.

If the installation of a sewage treatment plant is necessary, complete plans and specifications will be furnished by the Washington office. These designs do not involve the payment of any royalties, and will insure a satisfactory plant if instructions for construction, maintenance and operation are carefully followed.

These instructions are not to be considered as adequate specifications for materials to be furnished, or for work to be done under the lump sum form of contract. They are intended to serve in connection with the emergency form of contract, to enable work in the field to proceed immediately without the necessity of waiting for detailed drawings.

The preliminary surveys for a sewerage system and sewage treatment works should comprehend, as thoroughly as possible, all factors which have a direct bearing upon the cost of construction and maintenance of the system or plant after completion.

Soundings, to ascertain depth of soil overlying rock, should be made, and the depth to ground water level ascertained as nearly as possible.

SEWER PIPE LINES.

GENERAL CONSIDERATIONS.

The location of lines should be such as to reduce to a minimum the amount of excavation for sewers having self-cleansing grades.

Where length of line or depth of trench can be saved by crossing ravines, the sewer line may be carried on brick or concrete piers, or timber trestle above ground, if the ravine is narrow, or an inverted siphon may be used if the ravine is wide. For overhead lines, "Class A" cast iron pipe should be used if readily obtainable. Where iron pipe is not obtainable, vitrified clay pipe supported in a trough on a timber trestle, or machine banded wood pipe supported on piers or trestle, should be substituted. For inverted siphon, machine banded wood pipe of ample strength is to be used unless otherwise directed.

As far as possible, sewer mains and laterals should not be located within the limits of roadways, so as to avoid the necessity of using heavy cast iron frames and covers on manholes.

All changes in gradients and alignments should be made at manholes. In no case should the angle of deflection be greater than 90 degrees.

Manholes, of sizes and dimensions as shown on Plate 33, should be placed at the dead ends of all sewer lines and also at other points along the line of the sewer where required. No automatic flush tanks should be used.

Gradient Table, as follows, gives carrying capacities and approximate number of persons served by various sizes of vitrified clay sewer pipe, with a velocity of 2½ feet per second, flowing full.

In special cases, in order to avoid very deep excavations or the pumping of sewage, a minimum velocity of 20 inches per second is allowable.

TABLE OF MINIMUM GRADIENTS.

Carrying Capacity of Various Sizes of Pipe when Laid on Minimum Grade.
Velocity—2.5 f.p.s., Flowing Full.

Size, Inches	Minimum Gradient Per foot	Carrying Capacity Cu. ft. per second	Maximum No. of Men
6	.0064	0.50	1,200
8	.0044	0.87	2,085
10	.0034	1.35	3,285
12	.0026	1.91	4,580
15	.0020	3.00	7,200
18	.0016	4.30	10,320
21	.0014	6.00	21,600
24	.0012	7.80	34,560
27	.0010	9.60	47,520
30	.0008	11.30	59,760

TABLE OF MAXIMUM RATES OF DISCHARGE.

In determining the sizes of trunk and outfall sewers, the following table of maximum rates of discharge is to be used:

Regimental Units (Infantry)	Cu. Feet per second	No. of Men
One	1.5	3,600
Two	3.0	7,200
Three	4.5	10,800
Four	5.0	14,400
Five	5.5	18,000
Six	6.0	21,600
Seven	6.5	25,200
Eight	7.0	28,800
Nine	7.5	32,400
Ten	8.0	36,000
Eleven	8.5	39,600
Twelve	9.0	43,200
Thirteen	9.5	46,800
Fourteen	10.0	50,400
Fifteen	10.5	54,000
Sixteen	11.0	57,600
Seventeen	11.5	61,200

VITRIFIED CLAY PIPE.

Pipe used in the construction of the sewerage system is to be of good quality salt glazed vitified clay pipe, free from the following defects:

Earthy fracture; poor burning or glazing; deviation of more than half inch from straight line in length of pipe; angles, sharp curves or flat places; failure to make a close joint within ¼ inch when laid end to end; average diameter above or below standard by more than 3 per cent; more than 5 per cent excess of longest over shortest diameter; any crack extending entirely through the pipe; longitudinal fire cracks extending half way through the pipe; transverse cracks or any crack more than ⅛ inch wide; roughness on inner surface that would offer resistance to flow of sewage or tend to catch floating substances; any lump or blister more than two inches in length or deeper than one-fourth the thickness of pipe; broken blisters or irregularities on inner surface or any palpable defect other than the above.

CONCRETE PIPE.

With the approval of the Constructing Officer, machine molded concrete pipe may be used in the construction of sewer lines. This pipe should be made in strict accordance with the recommendations and specifications of the Portland Cement Association as set forth in a pamphlet entitled "Concrete Sewers," dated July, 1916, and published at 111 West Washington Street, Chicago, Illinois. Preference will be given to concrete pipe which has been formed in revolving molds.

EXCAVATIONS.

All excavations must be made by open cut from the surface. The banks should be kept as nearly vertical as possible, and should be properly sheeted and braced.

Trenches should be excavated to the line and grade as given by the engineer. Bell holes should be excavated to insure the pipe resting for its entire length upon the bottom of the trench.

The trenches should be sixteen inches wider than the greatest diameter of the pipe to be laid therein, eight inches of which should be on each side of the pipe.

The excavations for manholes, and other accessories, should be sufficient to leave at least one foot in the clear between their outer surfaces and the embankment or timber which may be used to protect it.

Should rock be encountered in the excavation for trenches, it is to be removed, by blasting if necessary, to a depth of 6 inches below the grade of bottom of pipe. The space between rock surface and bottom of pipe should be filled with firm earth or gravel, properly compacted, before the pipes are laid.

EMBANKMENTS.

Wherever the proposed grade of a pipe line is above the present surface of the ground, the top soil should be removed for a suitable distance on each side of line and an embankment formed of the best material available for the purpose. This material should be compacted by sprinkling and ramming in thin layers and left for as long a time as possible before the pipes are laid. The embankments should have a top width of not less than 3 feet and side slopes of two horizontal to one vertical. The top of all such embankments should be not less than 1½ feet above top of pipe.

PIPE LAYING.

All pipes should be laid in the following manner: A mason's line should be tightly stretched above the ground parallel to the axis of the sewer. This line should be supported over the center of the trench at intervals, not exceeding fifty feet on steep grades, and not exceeding twenty-five feet on flat grades. The exact grade for each pipe should be obtained by measuring down from this line to the invert of the sewer. As a test of alignment, a light held in a manhole must be visible through the sewer from the adjacent manholes. Each pipe should be carefully inspected immediately before it is laid, and no cracked, broken, or otherwise defective pipe should be used. Any defective pipe which may have been laid, should, upon discovery, at any time before the operation of the system, be taken up and replaced. The laying should proceed up grade, beginning at the lower end of the sewer. No pipe should be laid except in the presence of an inspector.

Where ordered, on account of wet ground or danger of root intrusion, sewers should be constructed of deep and wide socket pipe with special joints of improved asphaltic compound. The sockets should be thoroughly clean and free from grease and the annular space carefully caulked with jute or hemp. The compound should be poured in accordance with the instructions furnished by the manufacturer, and care taken not to overheat the compound.

JOINTS.

The joints should be caulked with jute or hemp and then carefully and thoroughly filled with Portland cement mortar, well rammed in with a wooden caulking tool, then overfilled and left with a smooth finish surface. The mortar is to be composed of one part of cement and one part of sand, with enough water added to give it the proper consistency. In pipes of sizes greater than 18 inches, the interior joints should be carefully filled. In pipes of all sizes, superfluous mortar should be removed from the joints by means of an approved form of follower or scraper. The work must be made perfectly water-tight at all joints, and any leaks or defects discovered must be immediately repaired. Any pipe which has been disturbed from any cause after being laid, must be taken up, the joints cleaned, and the pipe properly relaid. No part of the sewer should be laid in water, nor water allowed in or around it until the mortar has set hard.

All openings along the line of the sewers are to be securely closed as directed, and during suspension of work at night, or at any other time, a suitable stopper is to be placed at the end of the pipe last laid to prevent earth and other substances from washing in.

BACK FILLING.

Fine loose earth, free from large clods or stones, should be carefully dropped on both sides of the pipe and thoroughly and carefully rammed so as not to disturb the position of the pipe, nor to injure the cement joints, until the pipes are covered with at least one foot of earth. The rest of the material excavated may then be thrown on and tamped. The number of tampers should be not less than one-half the number of shovellers. Water settling will be permitted, and may be required. Whenever the trenches have not been properly filled, or if settlement occurs, they should be refilled, smoothed off and finally made to conform to the surface of the ground. Surplus material should be disposed of as directed.

MANHOLES.

Manholes should be constructed along the line of the sewers at such points as are shown on location map. The invert of manholes should be constructed of mortar composed of one part of

cement and two parts of sand. The invert should have a cross section of the exact shape of the inverts of the sewers which it connects, changes in size and grade being made gradually and evenly.

Where there are changes in the direction of the sewer, or entering branches, the center of the invert should have a true curve of as large a radius as the size of the manhole will permit.

All manholes should be provided with ¾-inch round iron steps, 12 inches long, built into the walls and spaced as shown on plan.

GREASE TRAPS.

A grease trap should be installed in the waste line from each kitchen or group of kitchens. General types are shown on Plates 39 and 40.

No sewage from lavatories or shower bath buildings should be discharged into kitchen waste lines above the grease trap.

SEWAGE TREATMENT PLANTS.

PRELIMINARY NOTES.

When practicable, sewage is to be discharged without treatment directly into adjacent streams or large bodies of water.

Where sewage treatment is required, detail drawings of the various structures will be furnished by the Washington office. Drawings other than those furnished as above, must be approved by the Washington office, prior to construction.

Special care should be exercised in selecting a site for the several features of a sewage treatment plant, in order to avoid unnecessary excavation, and to secure the best facilities for operation. As a general rule, a site should be selected for the sewage tanks such that the excavation and fill will be approximately equal. The longer dimension of the filter should be approximately parallel to the contours of the site. The sludge drying beds should be located as close as possible to the sewage tanks and at an elevation such as to give satisfactory gravity flow from tanks. The difference in levels between grade of influent pipe line of sewage tank and the outlet of under-drainage system of sprinkling filter should generally be approximately 15 feet.

As sewage treatment plants are usually located near a stream, it is very important to ascertain the flood level of stream and to take into consideration the probable cost of protecting the plant against injury by high water.

SEWAGE TANKS.

Tanks are to be of the single story type. For general type, see Plate 34. They should be located not less than 300 feet from the nearest barracks or other occupied building, and at a greater distance if practicable.

SPRINKLING FILTERS.

Where treatment of the sewage tank effluent is required, sprinkling filters should be constructed. For general type, see Plate 36.

SIPHON CHAMBERS.

Where sprinkling filters are used, the construction of a siphon chamber is necessary. For general type, see Plate 35.

SLUDGE BEDS.

Where sewage tanks are used, sludge drying beds are to be constructed. For general type of sludge beds, see Plate 38.

HUMUS AND CHLORINATING TANKS.

Where further treatment of sprinkling filter effluent is required, secondary sedimentation, chlorination or a combination of the two may be used. For general type of this combination, see Plate 37.

MATERIALS.

GATE VALVES.

Gates larger than two inches are to have cast iron body hub and spigot ends (unless otherwise shown on drawings), and those of two-inch size or smaller are to have brass body screw ends. All gate valves should be double-seat valves, full bronze mounted with non-rising stems. Valves which are set in the ground should be provided with suitable cast iron extension valve boxes and bases. The spindle should be capped with a two-inch square nut for operation by a tee handle wrench. One wrench should be provided for each valve. The spindle is to be of solid Tobin bronze. The seats are to be of bronze, screwed into body of valve. The faces are to be bronze, peened into gate and accurately faced. The gate should be of the double disc, wedge type. Valves should be provided with stuffing boxes constructed with followers. The stuffing box, including the seat for the stem, is to be of solid bronze or bronze bushed. The stuffing boxes should be so arranged as to be readily accessible, and to permit being packed under pressure.

NOZZLES.

The automatic dosing siphon and the spray nozzles for sprinkling filters will be purchased through the Washington office. They should be installed as shown on drawings, and in accordance with such detailed directions as the manufacturer may furnish.

CAST IRON PIPE.

Cast iron pipe larger than 6 inches should be "Class A," C. I. water pipe. Pipe 6 inches or smaller, should be standard C. I. soil pipe. The joints must be made tight, using oakum and molten lead thoroughly caulked in place.

FILTERING MATERIAL; TRANSPORTING AND PLACING.

The filtering material for sprinkling filters should consist of crushed or broken stone of hard, durable material. No stone which shows the slightest signs of disintegration, no soft limestone,

soft sandstone, shales or schists, should be permitted to be used. The filtering material should consist of rock which breaks or crushes in cubical form, or into pieces which are approximately equi-dimensional. The filtering material shall not contain dirt, dust, clay, or other foreign matter.

Especial care must be taken in transporting and placing filtering material to keep it clean. Any material which becomes dirty, either before or after it has been placed in the filter, should be removed and either cleaned in a satisfactory manner, or replaced with clean material. The material should be placed to the depths shown on the drawings with the top surface graded as shown.

METHODS OF CONSTRUCTION.

CLEARING AND EXCAVATING.

The entire area which embraces the site of proposed treatment works must be cleared of all trees, brush, woods and rubbish, which should be burned, or deposited where directed by the officer in charge.

The necessary excavating and grading for the several structures comprising the sewage treatment plant should be as indicated on drawings, and in accordance with the instructions to the constructing officer, and should be done with the view of making use of excavated materials for filling. The berm surrounding each structure should have a width of not less than 4 feet and should slope away from walls with an inclination of 1 in 20. All other slopes, whether in cut or in fill, should be not steeper than 2 horizontal to 1 vertical.

Wherever the foundation of any structure is at a higher elevation than the present surface of ground, the foundation embankment should be formed in the same manner as previously described for embankment for pipe lines. Every precaution should be taken to avoid settlement of the structure after completion.

FORMS.

All forms should be substantially constructed and braced, for receiving and placing the concrete. The lumber used for forms is to be dressed to a uniform thickness. Where concrete is exposed to view, the boards should be selected to secure the smoothest possible surfaces.

CONCRETE.

Concrete proportions, mixing and placing, for the various structures, should be in accordance with the details to be furnished by the Washington office. Mixing of the concrete, when the quantity warrants, should be by means of approved mechanical batch mixer. The quality of the concrete used for tanks and other liquid holding structures, must be especially dense and impervious. In general, material and methods for concrete work are described under heading of "Construction Notes" included in this Manual, and in the main should be observed for construction of sewage treatment structures.

Where work is stopped before completion of the mass, the concrete should be left with a clean, rough surface, without cavities or loose stones. All such surfaces should be approximately horizontal. No vertical joints should be permitted. When placing the fresh concrete upon the

surface of old concrete, all laitance, or scum, must be removed, using wire brushes where necessary, and the surfaces of the concrete thoroughly wet and broomed with a thin wash of neat cement grout.

FINISH OF CONCRETE.

After forms have been removed, all exterior exposed surfaces, excepting tops of walls, roofs, etc., should be thoroughly cleaned with water and brushes; projections should be removed, defective areas neatly pointed, and then uniformly rubbed with a cement brick.

The top surfaces of all walls, roofs, manholes, valve chambers, dosing tanks and pipe galleries of sprinkling filters shall be finished smooth.

REINFORCEMENT.

Steel rods should be wired, or secured in approved manner, so that they will be held accurately in position when concrete is being placed. Where splicing is required the ends of the rods shall overlap not less than 40 diameters, and be wired together at all points of contact.

In general, steel reinforcing material and methods are described under heading of "Steel Reinforcement for Concrete," under heading of "Construction Notes," included in this Manual.

INCINERATORS.

USES.

Incinerators are used where it is found desirable to provide a sanitary and economic device or plant for the destruction of animal and vegetable waste containing disease germs, also to furnish a plant for destruction of rubbish, manure, garbage and other combustible matter. It is not the policy of the Government to incinerate wastes having recoverable values. Wherever possible, garbage and manure should be sold.

RELATIVE ECONOMY OF INCINERATION AND REDUCTION.

From a sanitary point of view, destruction by fire is the best known method for the final disposal of refuse containing micro-organisms and larvæ. A properly designed furnace should be capable of disposing of garbage or waste matter from the moment it is fed into the charging magazine, without producing obnoxious gases. Garbage can be disposed of at lower cost by incineration than by reduction at military establishments. In order to obtain economical results with reduction plants, it is necessary to have a considerable amount of clean garbage to be disposed of continuously. It has been determined that a daily production of garbage amounting to 75 tons, is the minimum warranting consideration for treatment by the reduction process. The cost of installation, operation and maintenance of a modern reduction plant is decidedly higher than the corresponding expenses for incineration.

TYPES.

There have been in service at military establishments a large number of different types of incinerator, varying from the small hospital or kitchen type used at the National Guard Camps, Coast Artillery and Interior Army Posts, to units having a rated capacity of 50 tons per day of 24 hours.

The Army type of incinerator has been so designed that standard materials are used, such as are commonly employed in the construction of high temperature furnaces and can be purchased in an open market. Two types of Army incinerators have been designed: One employing natural draft only; the other using a forced draft by means of a motor-driven fan which forces air through a pre-heater into the area below the grates, from which place it is forced through pinhole grates and stoker. Another characteristic of the forced draft type is the employment of a mechanical stoker, which is used to advance the garbage and combustible waste, from charging magazine towards the front or firing grates.

DESIGN.

The ideal incinerating plant should consist of a suitable transfer platform, can washing equipment, and incinerator, with an appropriate building to house the same.

At permanent military establishments, the incinerator building should be of fire-proof construction.

LOCATION.

Practically all incinerators have a charging platform from eight to ten feet above the firing room floor level. A side-hill site will therefore offer advantages favorable to the cheapest construction, since approach to charging platform can be made without employing a ramp.

Plants should be removed as far as possible from the administrative buildings, officers' quarters and barracks.

The road to the incinerator should be so graded and surfaced that it can be used in all seasons.

The present practice is not to dump the garbage on the charging platform, but to deliver it in garbage cans at transfer platform. In all the new types of incinerators, the roadway is about four feet below the charging floor and platform.

An important reason for the location of the incinerator at the transfer station is the utilization of the heat, developed in the combustion of waste, to furnish hot water required for the cleaning and sterilization of garbage cans.

SIZE.

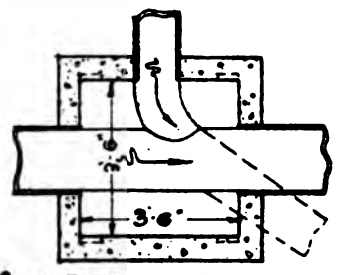
The capacity of the incinerator required for any camp or post depends upon local conditions.

The size of the incinerator unit at any camp should be large enough to cremate the entire output of garbage and refuse produced each day of 24 hours.

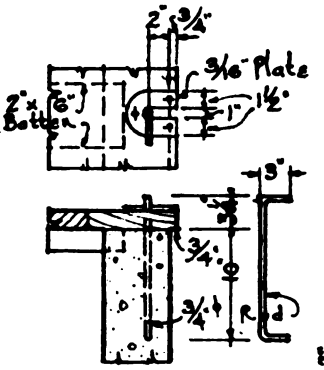
The amount of kitchen waste averages about one-half pound per man per day, while the total amount of combustible animal and vegetable waste varies from 1½ to 2 pounds per day per man.

At very small posts and at very large posts, the average production may be less in amount than indicated by above rates.

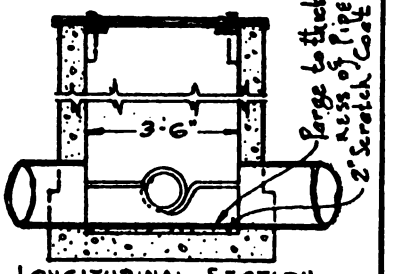
For small posts and hospitals, it is recommended that an incinerator having a capacity of 250 pounds per hour be made the minimum size. An approximate rule for determining the size of incinerator is to provide a capacity of one ton per eight hours for each one thousand men in camp or hospital.



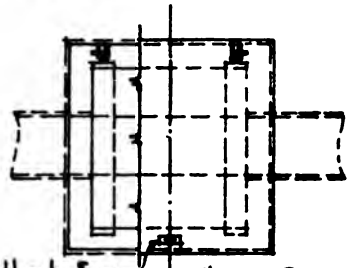
PLAN TAKEN ON CENTER LINE OF MAIN SEWER PIPE.



DETAIL OF COVER HOLDER.



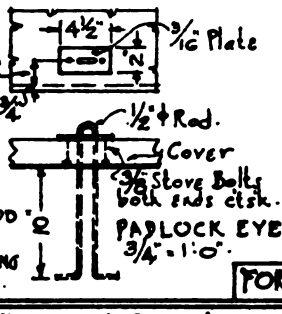
LONGITUDINAL SECTION SHOWING BRANCH



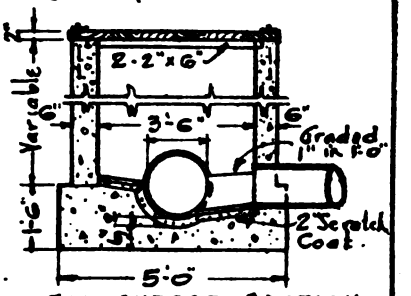
Padlock Eye

HALF PLAN SHOWING TOP COVER REMOVED.

HALF PLAN OF WOOD COVER SHOWING METHOD OF FASTENING COVER IN PLACE.

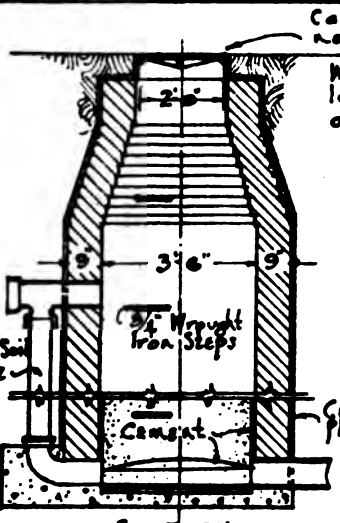


PADLOCK EYE 3/4" = 1'0"

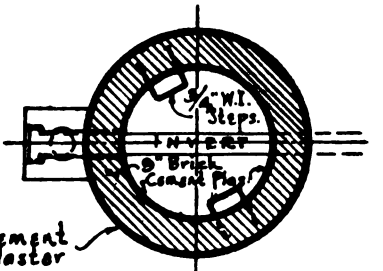


TRANSVERSE SECTION 1/4" = 1'0"

FOR ORIGINAL SEE DRAWING 672-1

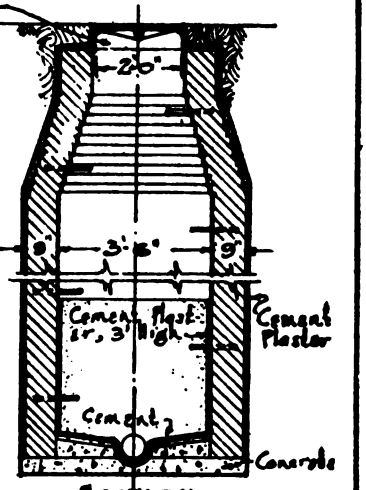

Cast Iron Frame and Cover to weigh not less than 400 pounds
Wood Cover, fastened by Padlock, may be installed in place of cast iron frame and cover
2'0"
3'6"
¾" Wrought Iron Steps
C.I. Soil Pipe
Cement
Cement plaster

SECTION DROP MANHOLE.

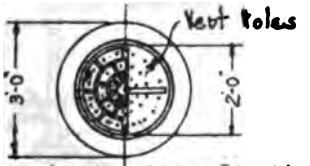


PLAN DROP MANHOLE.

SCALE 1/4" = 1 FOOT.

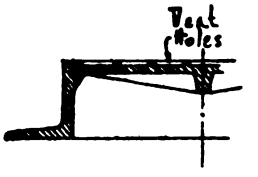


SECTION.

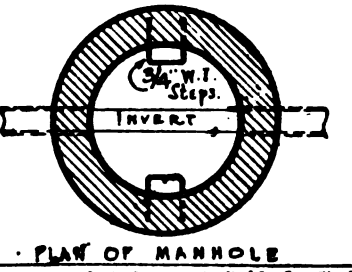


FROM ABOVE. FROM BELOW.

PLAN OF C.I. FRAME & COVER. 1/4" = 1'0"



HALF SECTION OF C.I. FRAME AND COVER. 3/4" = 1'0"



PLAN OF MANHOLE

STANDARD BRICK MANHOLE DETAILS

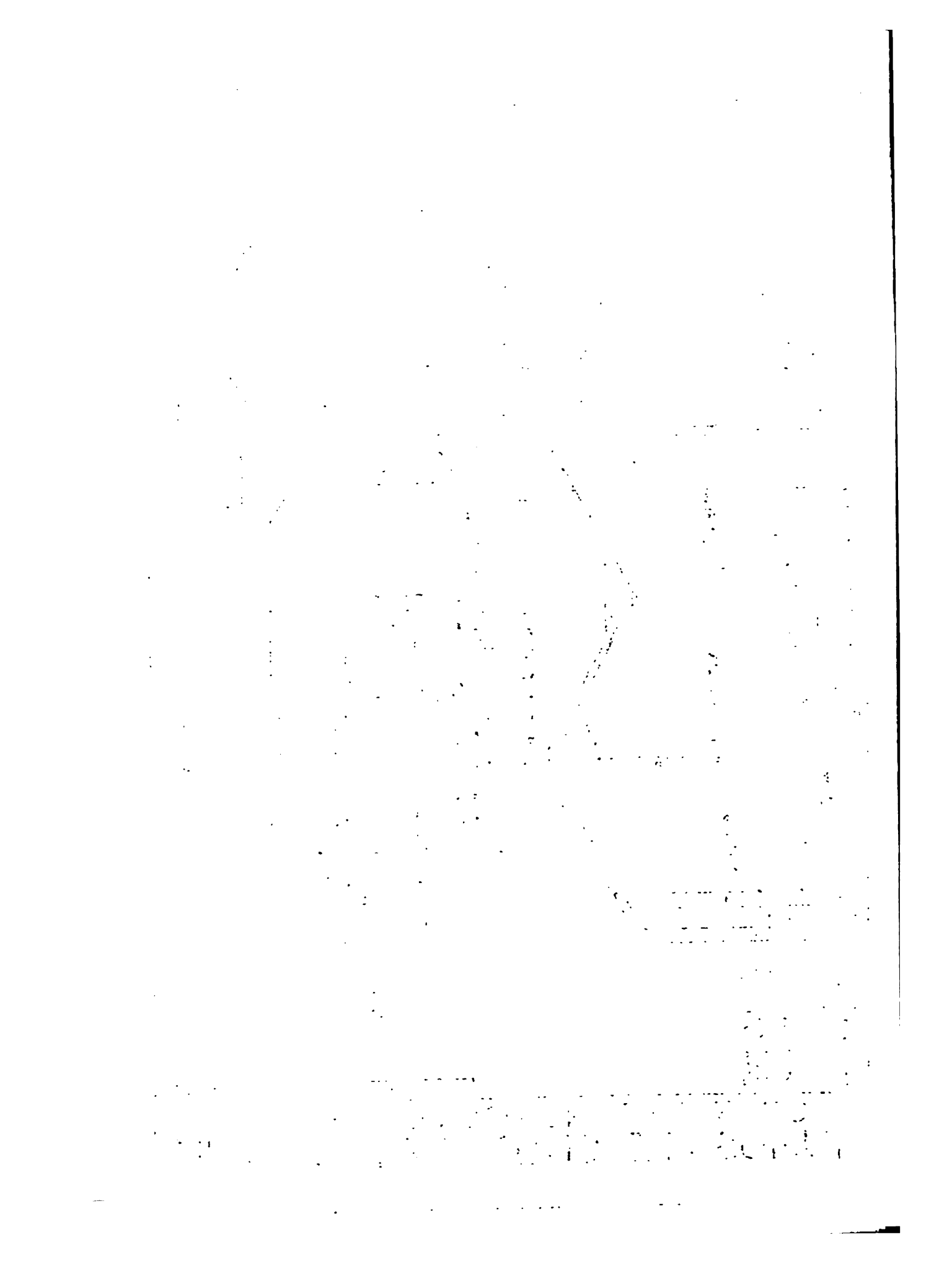
FOR ORIGINAL SEE DRAWING 672-16

CONSTRUCTION DIVISION OF THE ARMY
STANDARD CONCRETE MANHOLE
STANDARD MANHOLE: BRICK OR CONCRETE

FOR ORIGINAL SEE DRAWING 672-30

CONSTRUCTION DIVISION OF THE ARMY

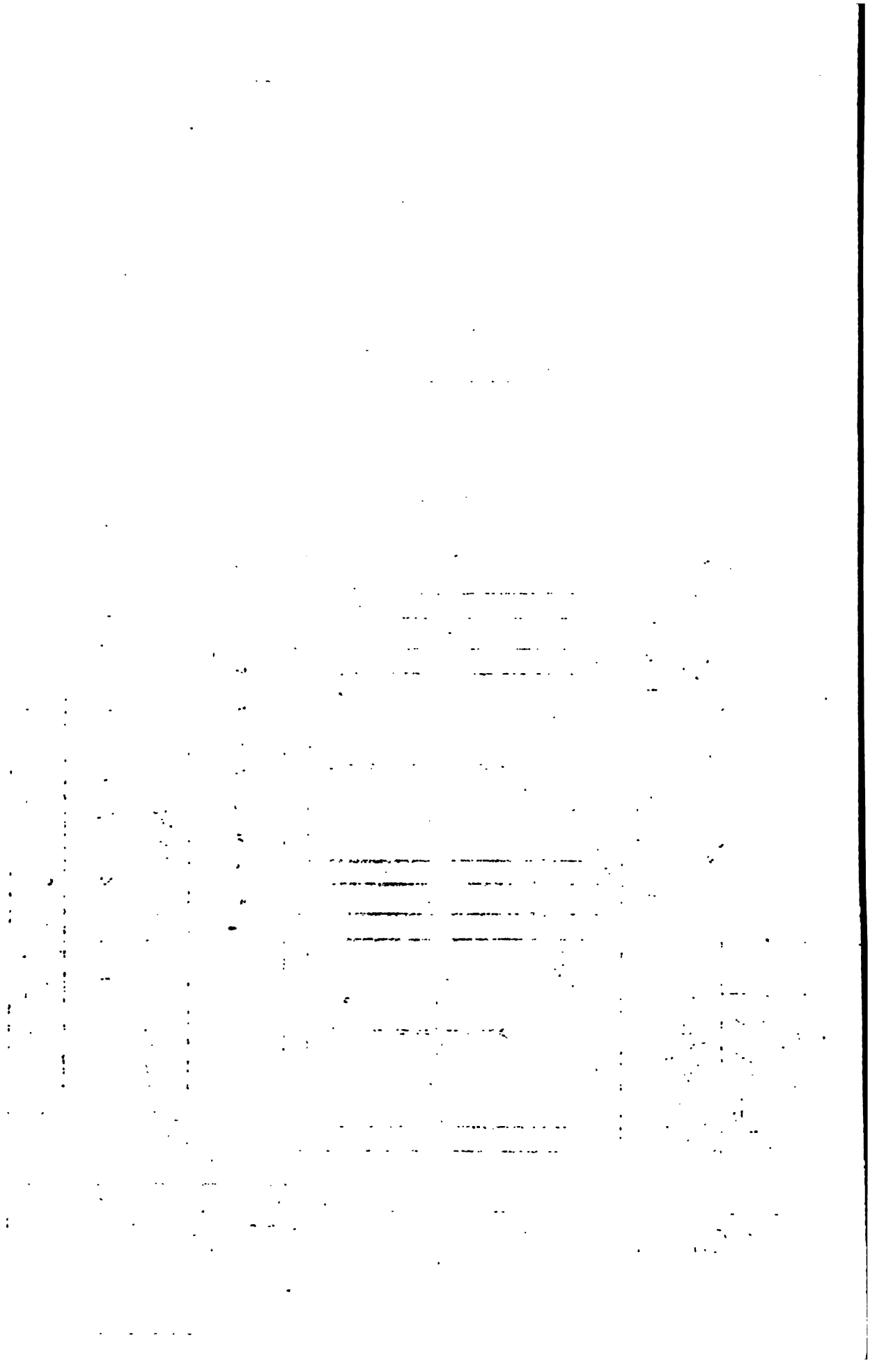
HUMUS AND CHLORINATING TANK

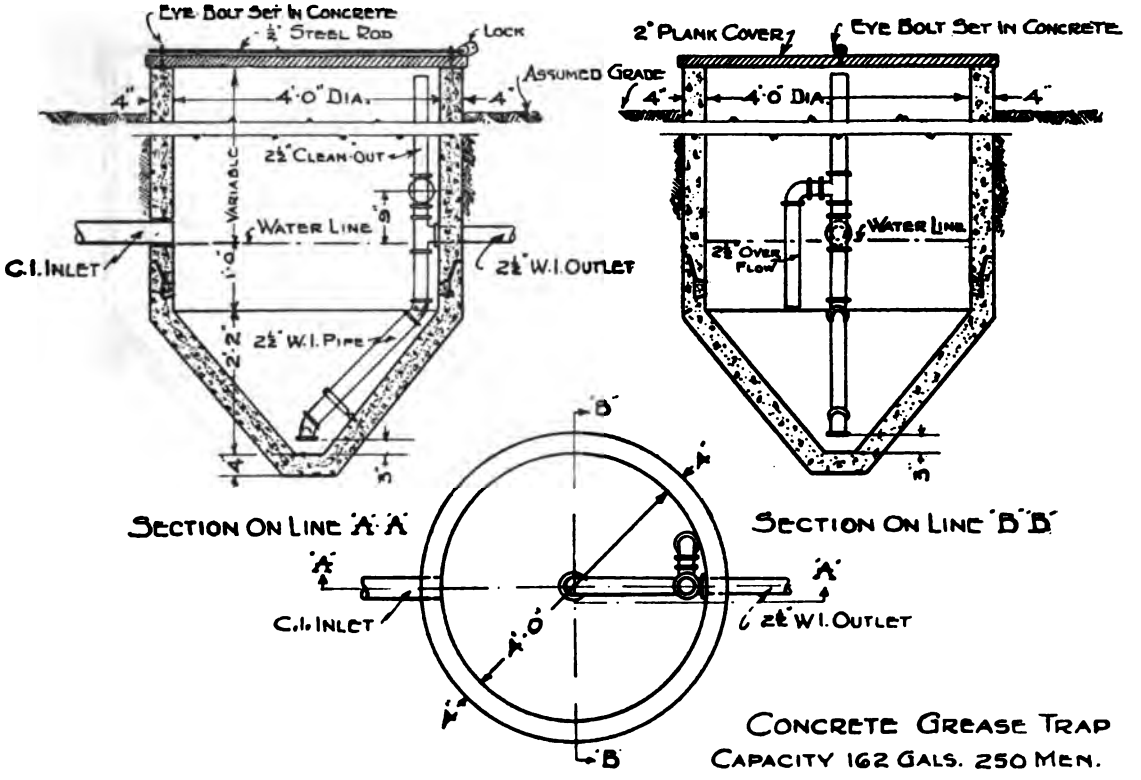


FOR ORIGINAL SEE DRAWING 672-71

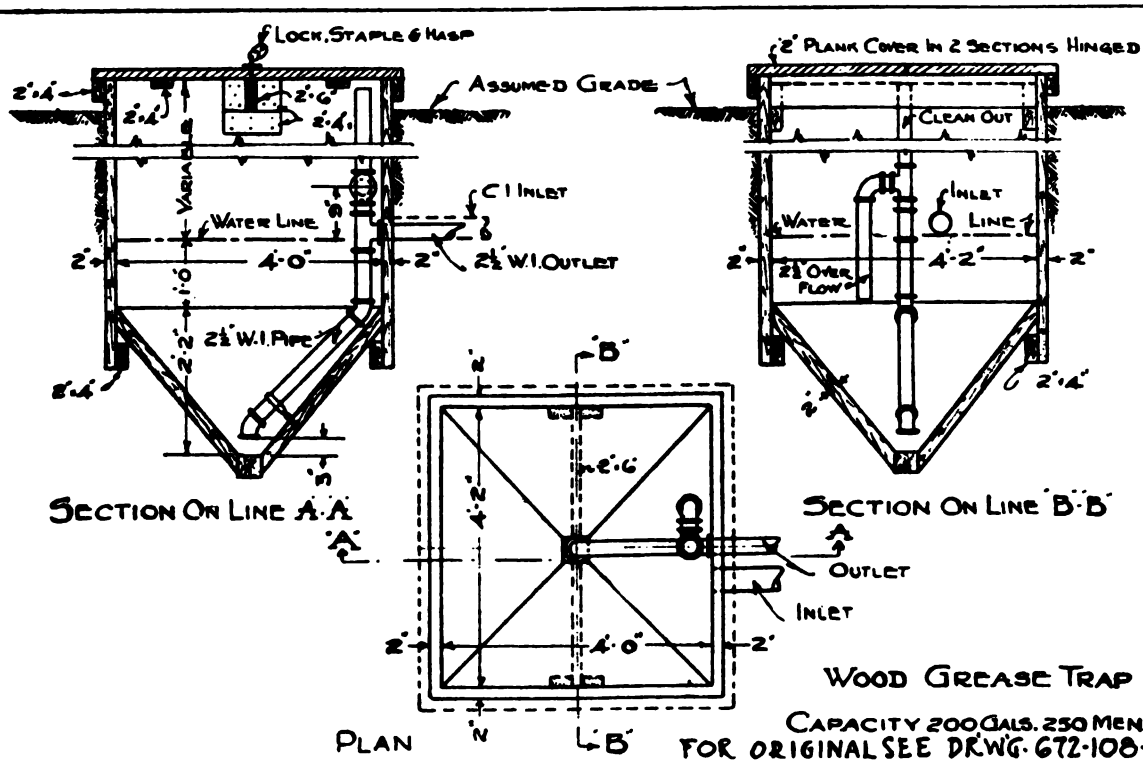
CONSTRUCTION DIVISION OF THE ARMY

SLUDGE BED



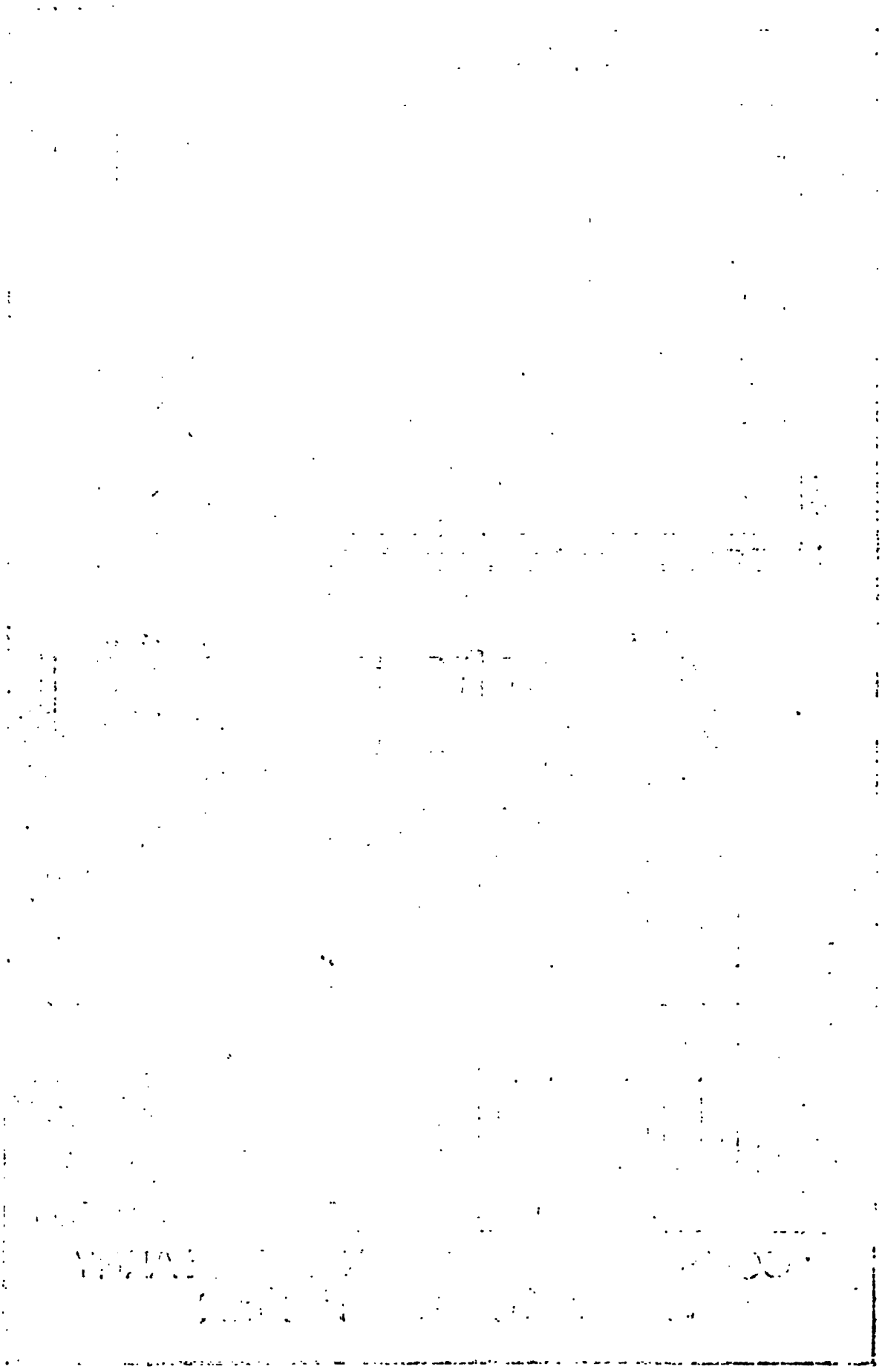


CONCRETE GREASE TRAP
CAPACITY 162 GALS. 250 MEN.
PLAN FOR ORIGINAL SEE DRAWING 672-136



WOOD GREASE TRAP
CAPACITY 200 GALS. 250 MEN.
FOR ORIGINAL SEE DRWG. 672-108

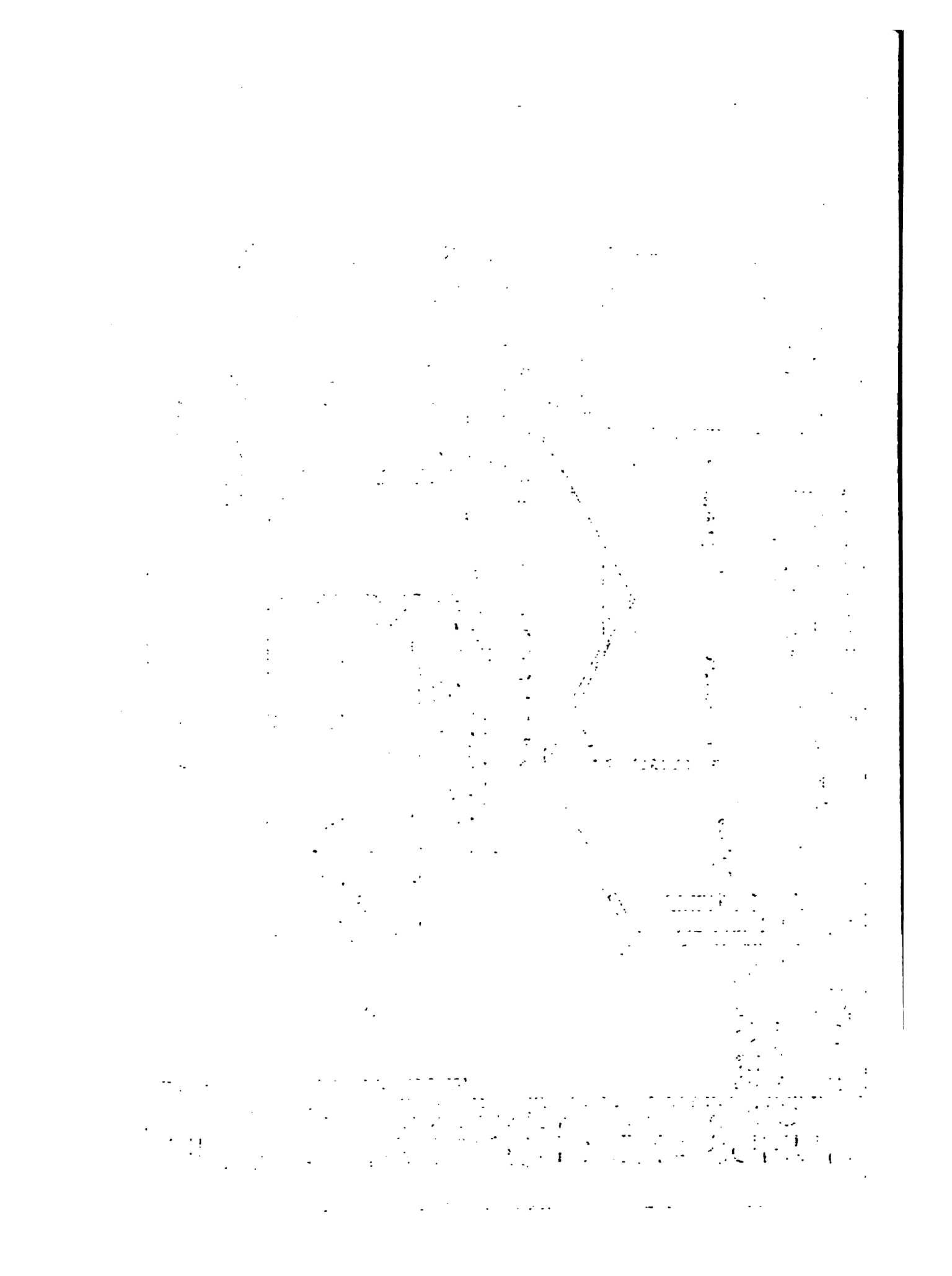
CONSTRUCTION DIVISION OF THE ARMY
STANDARD GREASE TRAPS
CONCRETE & WOOD



FOR ORIGINAL SEE DRAWING GTZ-30

CONSTRUCTION DIVISION OF THE ARMY

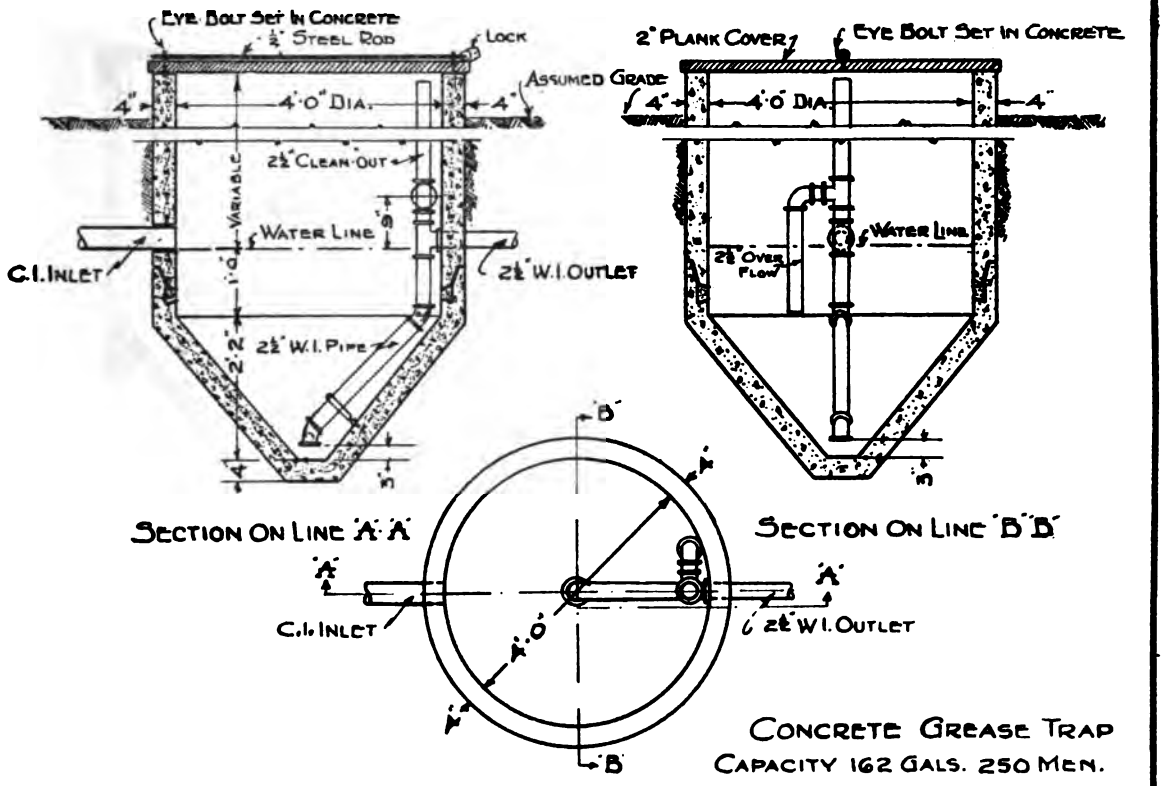
HUMUS AND CHLORINATING TANK

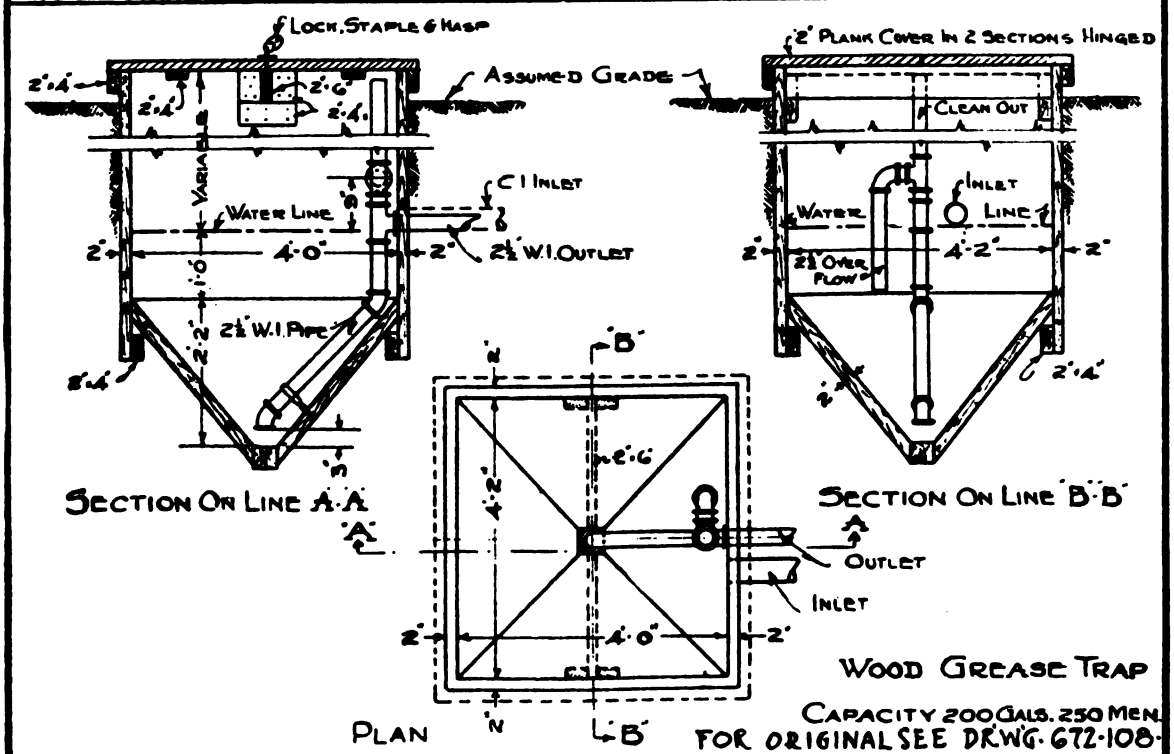


FOR ORIGINAL SEE DRAWING 672-71

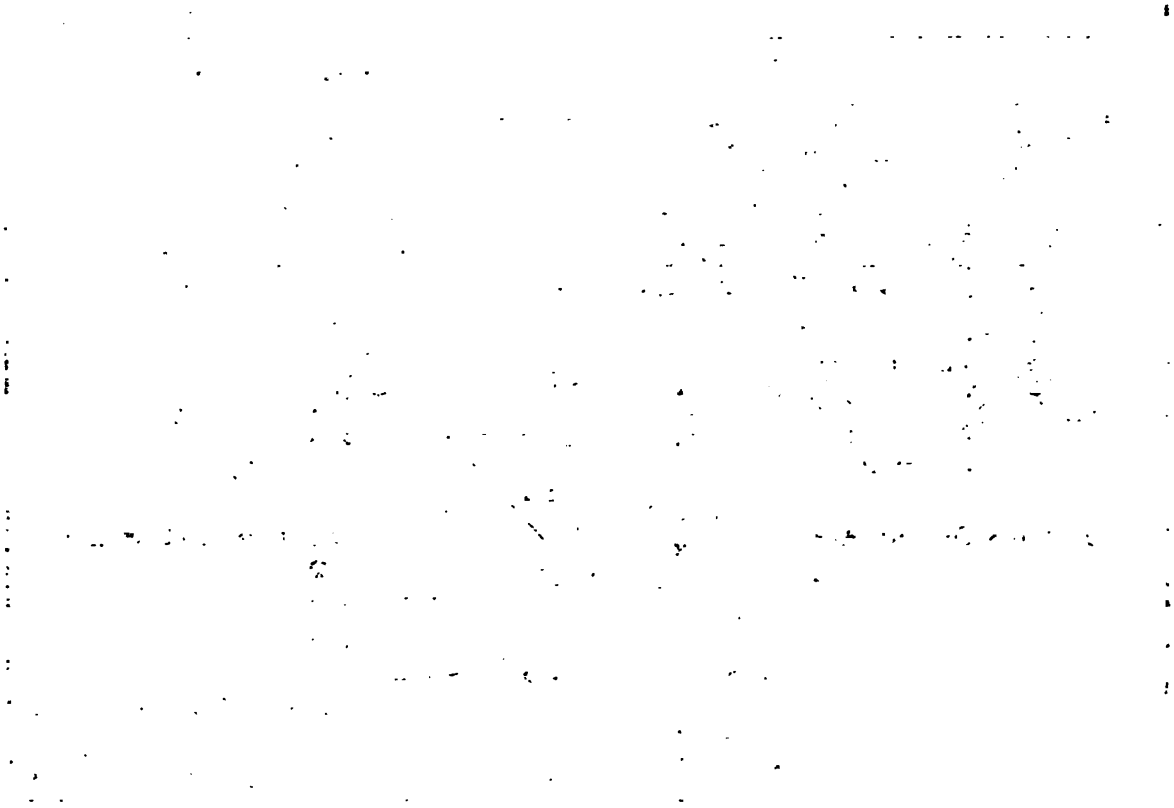
CONSTRUCTION DIVISION OF THE ARMY

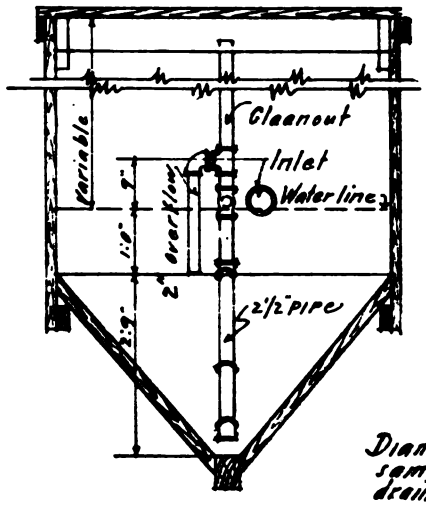
SLUDGE BED



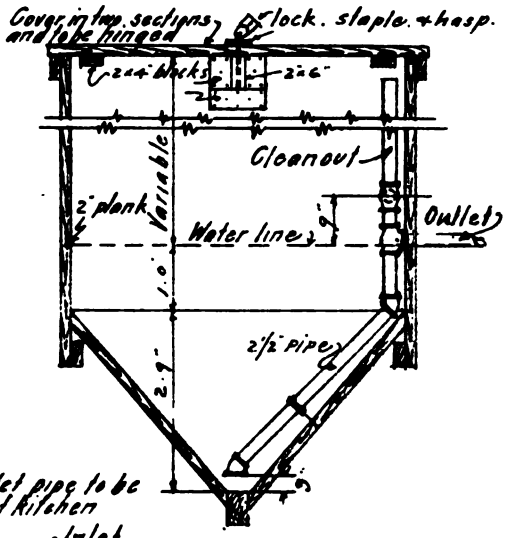


CONSTRUCTION DIVISION OF THE ARMY
STANDARD GREASE TRAPS
CONCRETE & WOOD

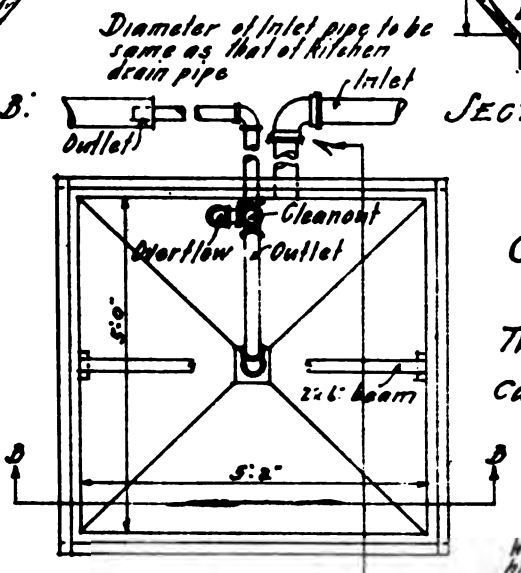




SECTION ON LINE B-B.

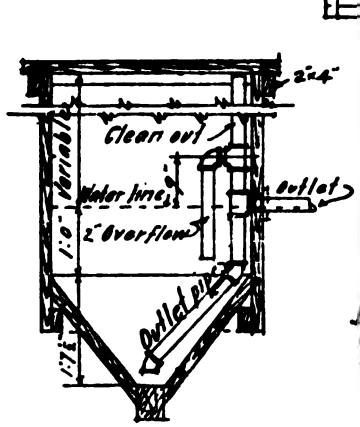


SECTION ON LINE A-A.

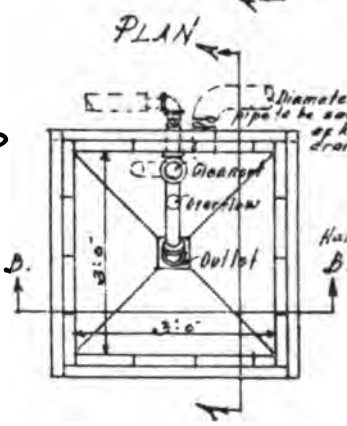


PLAN

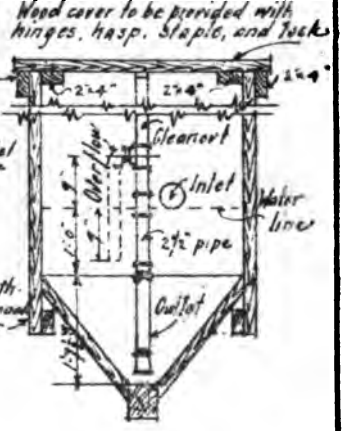
GREASE TRAP.
for
TWO KITCHENS
Capacity 360 Gals.
300 Men.



SECTION ON LINE A-A



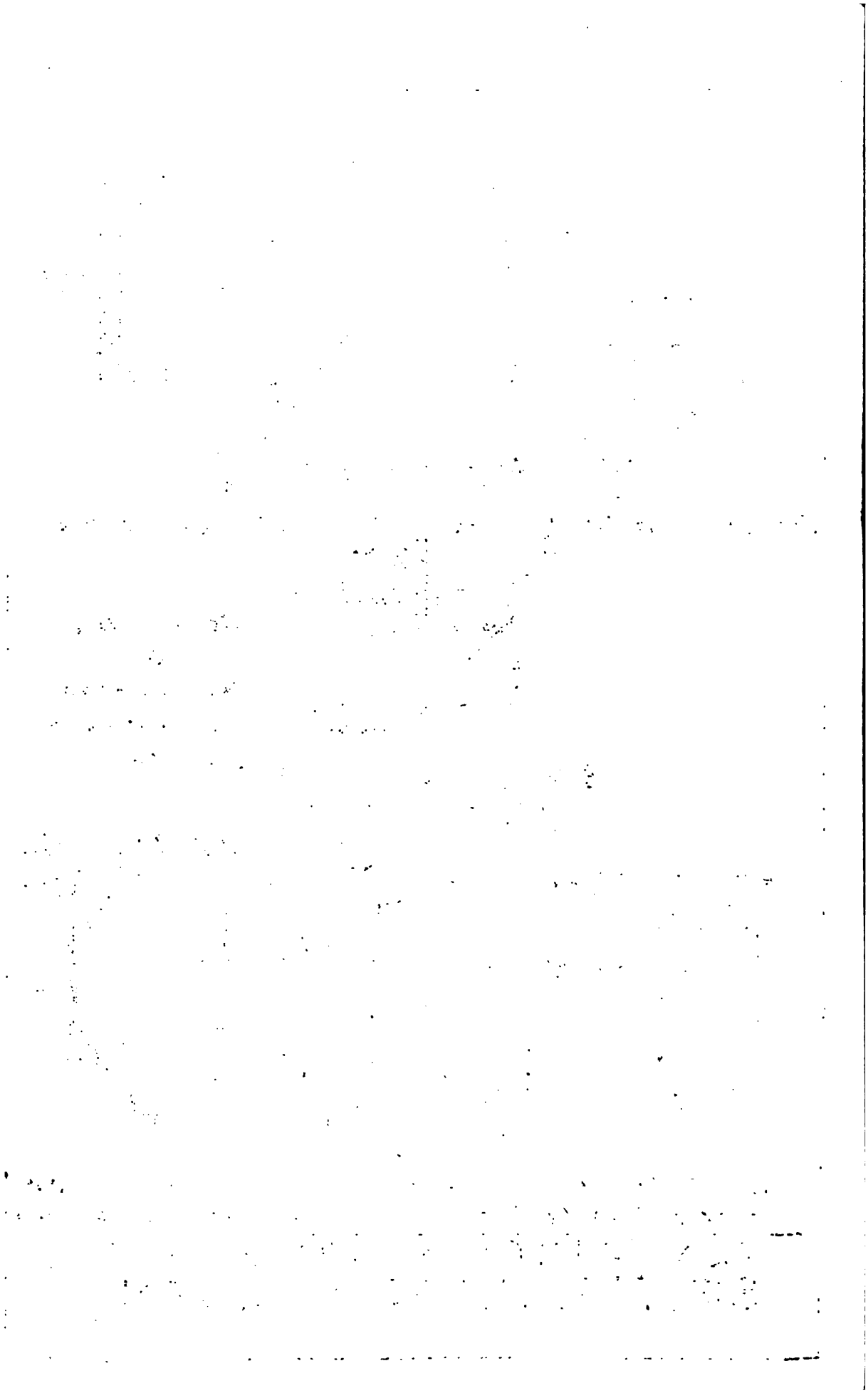
PLAN.

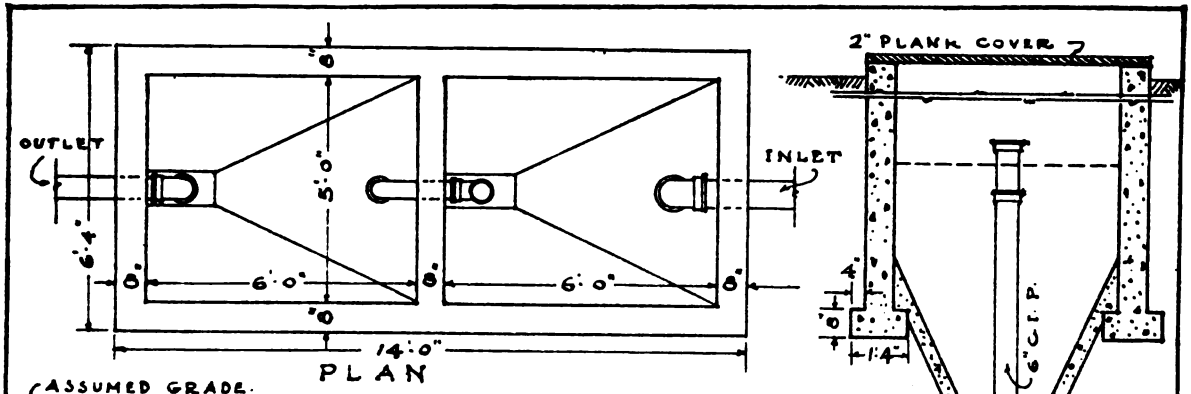


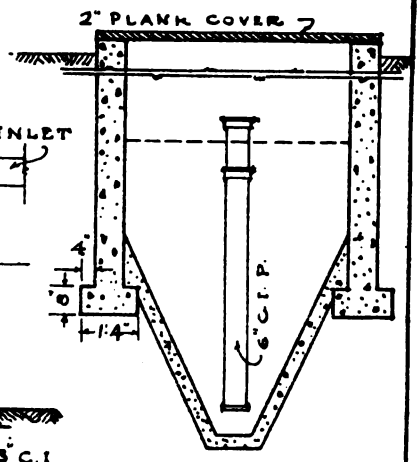
SECTION ON LINE B-B.

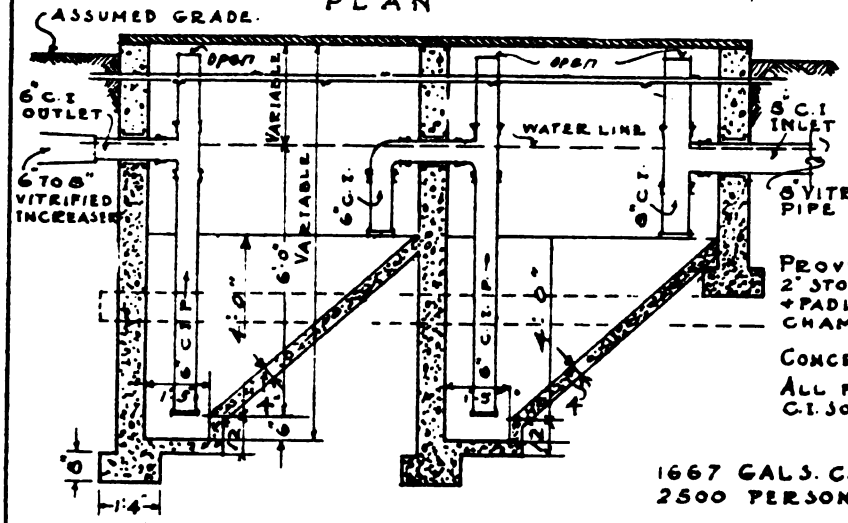
GREASE TRAP for ONE KITCHEN Capacity 106 Gals. 150 Men or less.

CONSTRUCTION DIVISION OF THE ARMY
STANDARD WOOD GREASE TRAP









NOTES:

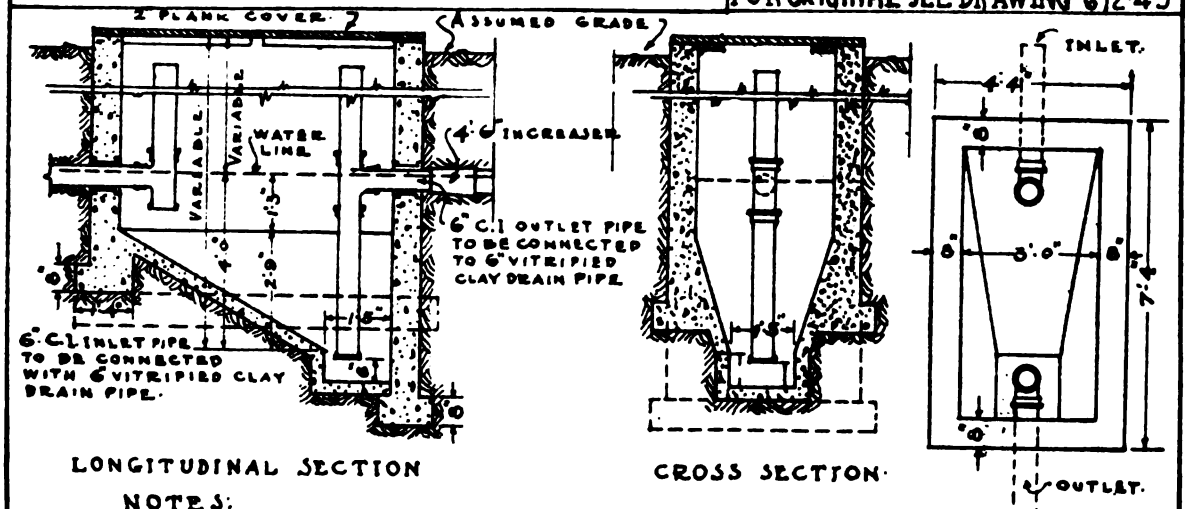
PROVIDE COVER FOR TANK OF 2" STOCK, PROVIDE HINGES, HASPS, & PADLOCKS FOR DOOR TO EACH CHAMBER.

CONCRETE MIXTURE 1:2:4.

ALL PIPE TO BE STANDARD C.I. SOIL PIPE.

1667 GALS. CAPACITY FOR 2500 PERSONS.

FOR ORIGINAL SEE DRAWING C72-43



NOTES:

PROVIDE COVER OF 2" STOCK WITH NECESSARY HINGES, HASPS, PADLOCK ETC.

CONCRETE MIXTURE. 1:2:4.

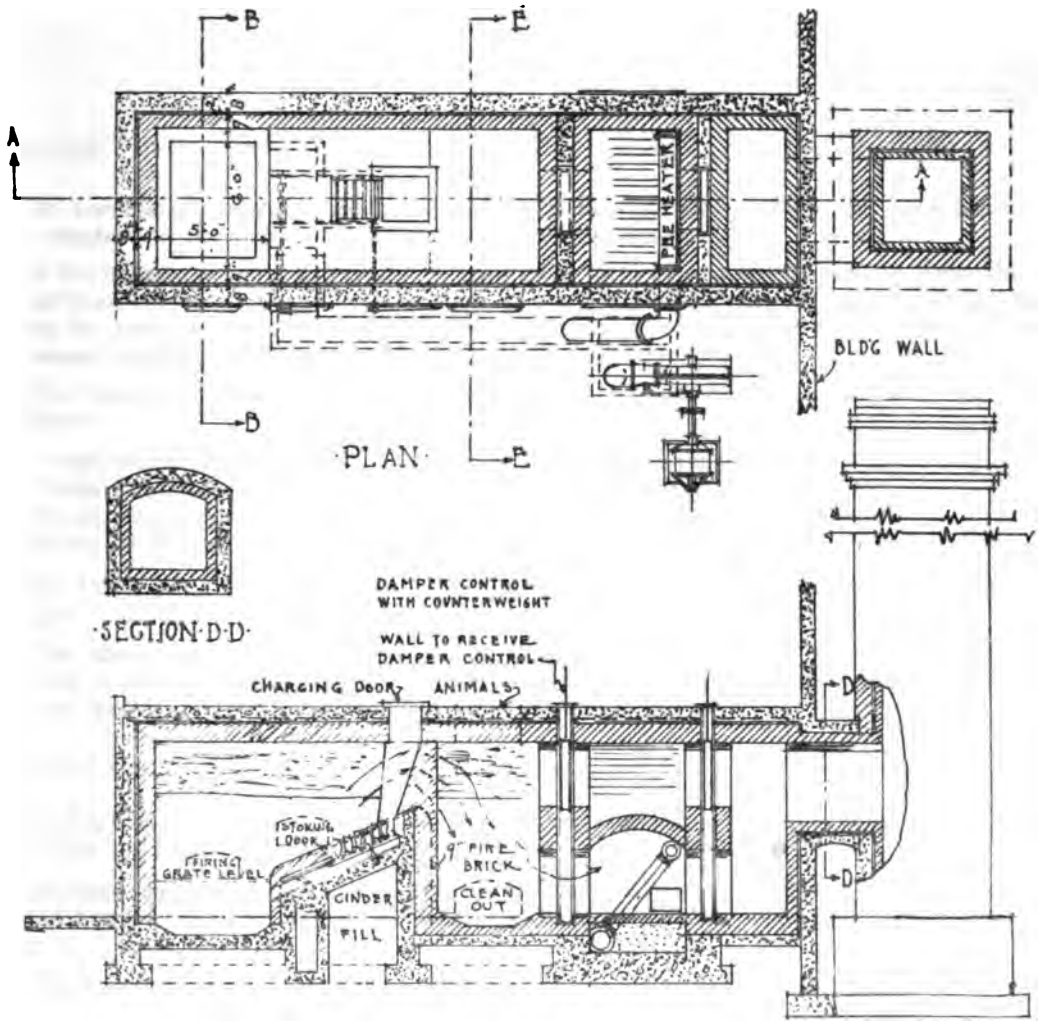
ALL PIPE TO BE STANDARD C.I. SOIL PIPE.

GREASE TRAP MAY BE CONSTRUCTED OF 2" PLANK WALLS AND CONCRET FLOOR

FOR ORIGINAL SEE DRAWING C72-47.

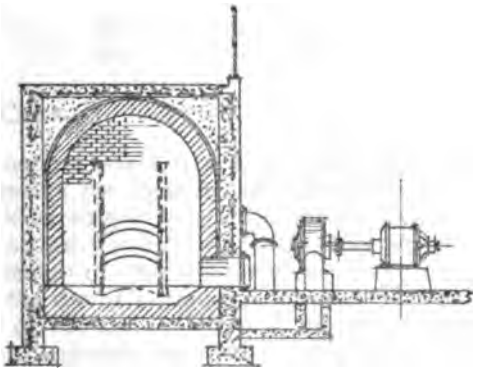
CONSTRUCTION DIVISION OF THE ARMY

CONCRETE GREASE TRAP

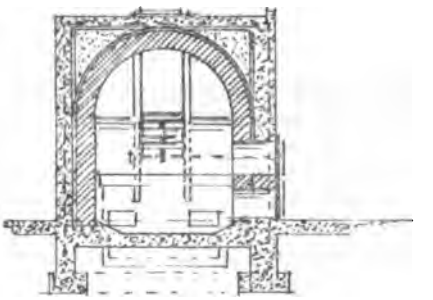


·SECTION·D·D·

·SECTION·A·A·



·SECTION·E·E·



·SECTION·B·B·

FOR ORIGINAL SEE DRAWING 414,43,131,10:

CONSTRUCTION DIVISION OF THE ARMY
U.S. STANDARD INCINERATOR
10 TON CAPACITY

OPERATION.

To successfully operate an incinerator, it is necessary to exercise the same kind of judgment required in the firing and operation of a steam boiler.

If the incinerator is in daily use, the regulating damper should be used to close the connection between combustion chamber and stack at night, or when work of incinerator has been suspended for the day, in order to retain the heat within the incinerator walls. This will save fuel and insure prompt resumption of operations the following day.

The Construction Division files contain standard drawings for incinerators and buildings as follows:

1-ton incinerator—No. 414.	43-11	Building No. 414-43-13.
5-ton incinerator—No. 414.	43-12	Building No. 624-7-101.
10-ton incinerator—No. 414.	43-131	Building No. 414-43-132.
20-ton incinerator—No. 414.	43-9-10-133-134.	

On Plate No. 41 of this Manual, is shown a drawing of a U. S. Standard Ten-Ton Incinerator.

The above instructions are not to be considered an adequate specification for the construction of an incinerating plant. Before any work in this connection is begun, detailed drawings and specifications must be secured from the Washington office.

GARBAGE CANS.

Garbage cans should be made of galvanized steel plate, with the bodies made of No. 23 gauge, lids and bottoms of No. 21 gauge.

Garbage can recommended is that having fluted body and heavy reinforcing steel bands at top and bottom, or that having fluted body with vertical angle irons and reinforcement of the body.

The following table shows the dimensions and capacity of standard cans:

Can No.	Weight with lid lbs.	Weight without lid lbs.	Capacity gals.	Height inches	Diameter inches
1	26	23	20	25	15¾
2	30	26	27	25	18
3	33	29	35	25	20½

CLEANING CANS.

The Construction Division has developed a simple can washing equipment which meets all the requirements for cleaning and sterilizing garbage cans. The method consists of a concrete soaking tank varying in length, depending upon the size of the camp or post. This tank is fitted with steam or hot water coils and the cans are placed on an inclined rack and allowed to remain a sufficient length of time for the grease to be cut by the action of the hot water, which is made alkaline by the use of suitable chemicals. The cans are then removed from the soaking tank and the interior of the can subjected to the spray action of a hose nozzle, and the exterior of the can to an ordinary shower sprayer. These sprayers are placed within metal housing.

The can washing equipment is shown on United States Standard Garbage Can Washing Plan No. 414. 43-130, in the files of the Construction Division.

BUILDINGS.

CONSTRUCTION NOTES.

PRELIMINARY.

A large number of drawings for buildings of various types, not listed or included in this Manual, are available and on file in the Washington office. Before proceeding with drawings for buildings, not so listed, inquiry should be made of the Washington office, stating general requirements, to ascertain if suitable drawings are available.

Standard Cantonment Buildings generally used, are listed on Plate Nos. 42, 43 and 44. Many of the standard buildings, such as warehouses, dock sheds, laundries, cafeterias, dormitories, dwellings, welfare buildings, theatres, delousing plants and many of the ordnance buildings, etc., etc., are listed on Plate No. 67. Refrigerating buildings are listed on Plate No. 150.

Instructions contained under this heading should be taken as a general guide for various constructions. The intention is to outline broadly the methods adopted and used by the Construction Division of the Army for war emergency building projects.

These instructions are not to be considered as adequate specifications for materials to be furnished, or for work to be done under the lump sum form of contract. They are intended to serve in connection with the emergency form of contract which was adopted to enable work in the field to proceed immediately without the necessity of waiting for detailed drawings.

Before beginning the preparation of designs for emergency structures, consideration should be given to restrictions imposed on the use of materials. Reference should be made to "Standard Specifications and Details for War Building Projects," prepared under the auspices of the War Industries Board, Building Materials Division, in so far as they may apply to the purposes of this Manual.

UNIT STRESSES AND LOADS.
FOR USE IN
THE DESIGN OF EMERGENCY STRUCTURES.

STRUCTURAL STEEL.

Note: Material should conform to the "Standard Specifications for Structural Steel for Buildings," of the "American Society for Testing Materials."

Unit Stresses: The principal unit stresses to be used, expressed in pounds per square inch, are as follows:

Tension	Net section, rolled steel	18,000
Direct compression	Rolled steel and steel castings	18,000
Bending	Extreme fibers of rolled sections and girders	18,000
Bending	Extreme fibers of pins	26,000
Shear	On shop rivets and pins	13,000
Shear	On bolts and field rivets	11,000
Shear	Average on webs, gross sectional	11,000
Bearing pressure	On shop rivets and pins	27,000
Bearing pressure	On bolts and field rivets	22,000

Columns and Struts: Use values given in the following table:

$\frac{L}{R}$	Unit Stress lbs. per sq. in.	$\frac{L}{R}$	Unit Stress lbs. per sq. in.
60 or less	14,000	130	7,000
70	13,000	140	6,500
80	12,000	150	6,000
90	11,000	160	5,500
100	10,000	170	5,000
110	9,000	180	4,500
120	8,000		

Max. length for main members: $\frac{L}{R} = 120$

Max. length for bracing struts: $\frac{L}{R} = 180$

L = unsupported length in inches; R = least radius of gyration in inches.

Compression Flanges of Beams and Girders: Use values given in the following table:

$\frac{L}{B}$	Unit Stress	$\frac{L}{B}$	Unit Stress
10 or less	18,000	30	10,000
15	16,000	35	8,000
20	14,000	40	6,000
25	12,000		

Max. length of unsupported beam = 40 B

L = unsupported length of beam; B = width of flange.

For cranes, conveyors, etc., add 25% to live load for impact.

For cranes allow 10% of moving load for lateral pressure on each crane girder.

For bracing and combined stresses due to wind, dead and live load, the working stresses may be increased 25%, but the section should not be less than required for dead and live loads only.

CAST IRON.

Material: Should conform to the "Standard Specifications for Gray Iron Casting," of the "American Society for Testing Materials."

Unit Stresses: To be used, expressed in pounds per square inch, are as follows:

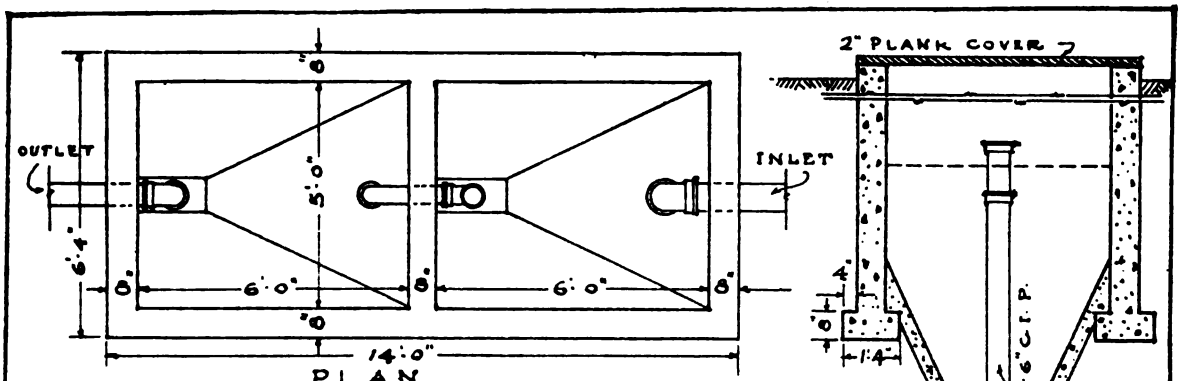
Columns ..... $10{,}000 = 60\frac{L}{R}$
in which L = length of column in inches; R = least radius of gyration in inches.

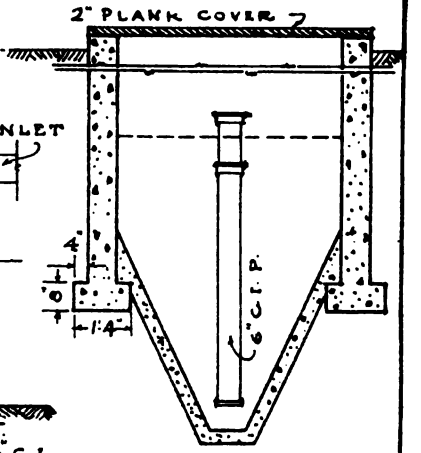
Max. length of column = 20 diameters

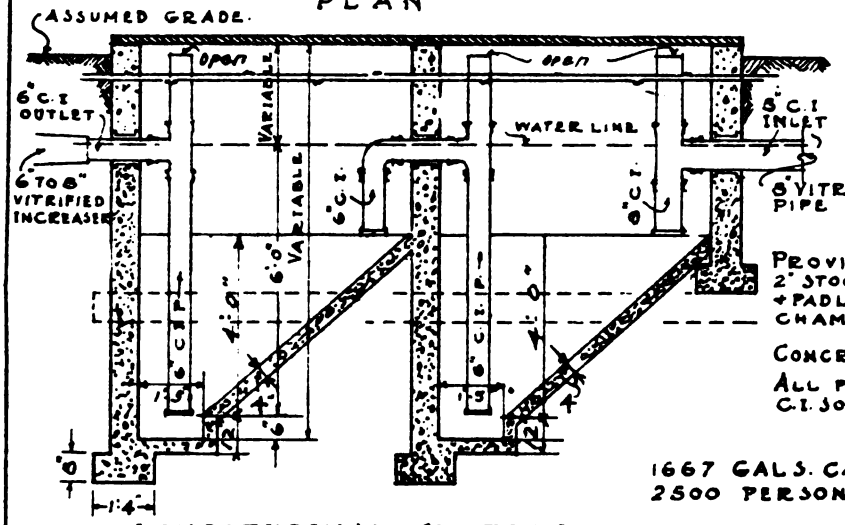
Bending—extreme fiber stress; compression	10,000
Bending—extreme fiber tension	2,500
Bending—extreme fiber Wall Plates	6,000
Shear in brackets	1,500

REINFORCED CONCRETE.

Except as otherwise noted, the unit stresses, general assumptions and design, should conform to the recommendations in final report of "Joint Committee of Engineering Societies on







NOTES:

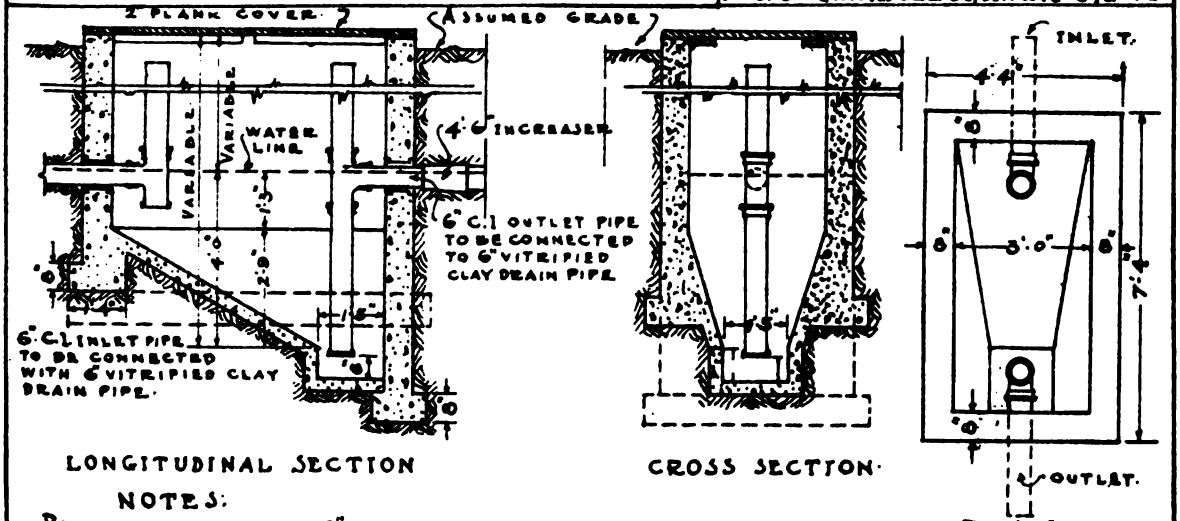
PROVIDE COVER FOR TANK OF 2" STOCK, PROVIDE HINGES, HASPS, & PADLOCKS FOR DOOR TO EACH CHAMBER.

CONCRETE MIXTURE 1:2:4.

ALL PIPE TO BE STANDARD C.I. SOIL PIPE.

1667 GALS. CAPACITY FOR 2500 PERSONS.

FOR ORIGINAL SEE DRAWING 672-43



NOTES:

PROVIDE COVER OF 2" STOCK WITH NECESSARY HINGES, HASPS, PADLOCK ETC.

CONCRETE MIXTURE, 1:2:4.

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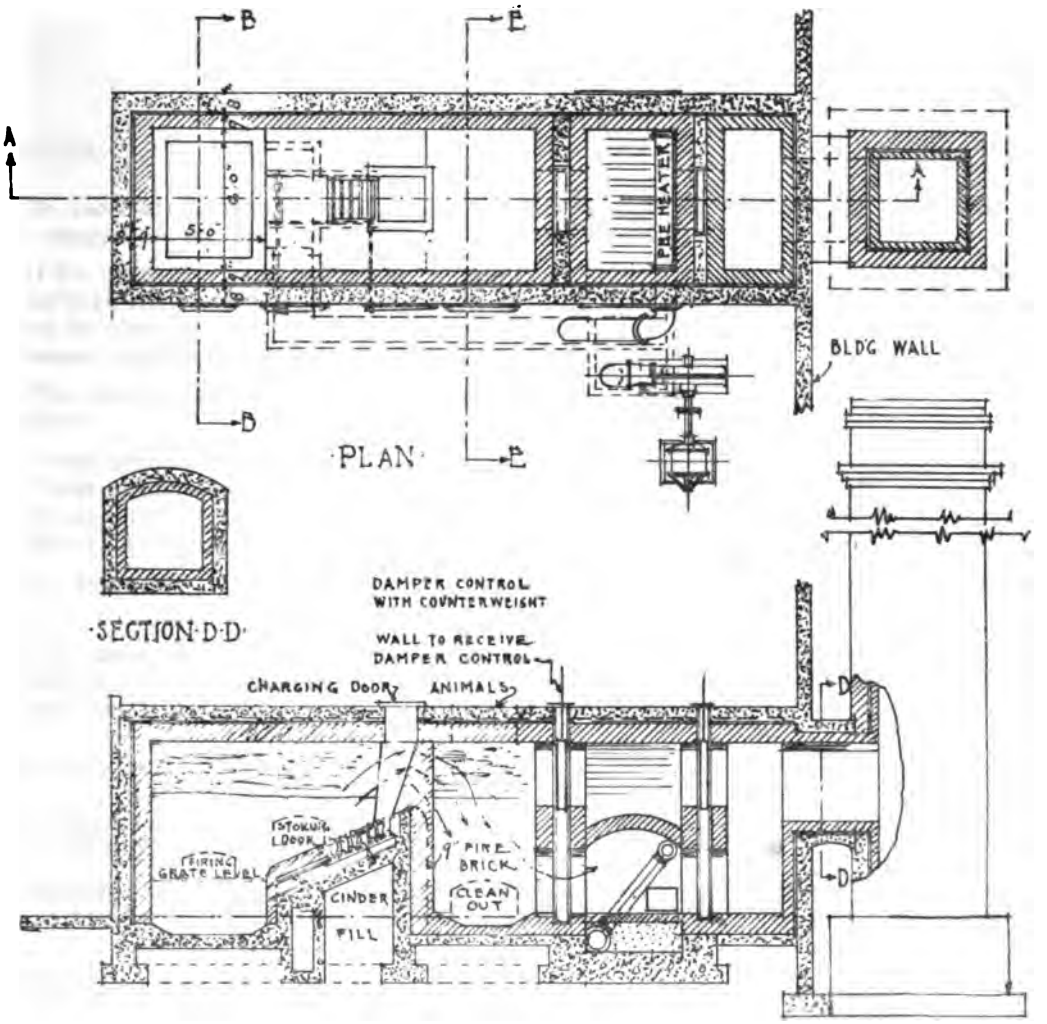
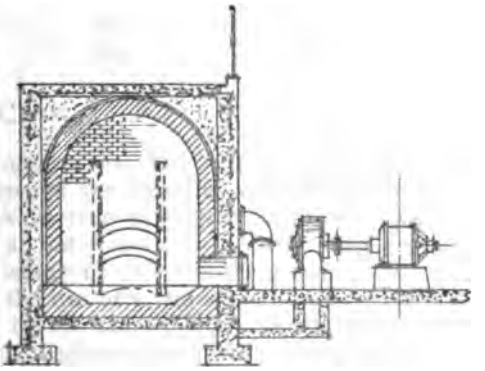
GREASE TRAP MAY BE CONSTRUCTED OF 2" PLANK WALLS AND CONCRET FLOOR

FOR ORIGINAL SEE DRAWING 672-47.

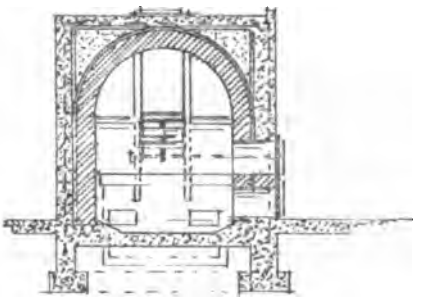
CONSTRUCTION DIVISION OF THE ARMY

CONCRETE GREASE TRAP





SECTION E-E



SECTION B-B

FOR ORIGINAL SEE DRAWING 414-43-131-10

CONSTRUCTION DIVISION OF THE ARMY
U.S. STANDARD INCINERATOR
10 TON CAPACITY

OPERATION.

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If the incinerator is in daily use, the regulating damper should be used to close the connection between combustion chamber and stack at night, or when work of incinerator has been suspended for the day, in order to retain the heat within the incinerator walls. This will save fuel and insure prompt resumption of operations the following day.

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10-ton incinerator—No. 414. 43-131	Building No. 414-43-132.
20-ton incinerator—No. 414. 43-9-10-133-134.	

On Plate No. 41 of this Manual, is shown a drawing of a U. S. Standard Ten-Ton Incinerator.

The above instructions are not to be considered an adequate specification for the construction of an incinerating plant. Before any work in this connection is begun, detailed drawings and specifications must be secured from the Washington office.

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CLEANING CANS.

The Construction Division has developed a simple can washing equipment which meets all the requirements for cleaning and sterilizing garbage cans. The method consists of a concrete soaking tank varying in length, depending upon the size of the camp or post. This tank is fitted with steam or hot water coils and the cans are placed on an inclined rack and allowed to remain a sufficient length of time for the grease to be cut by the action of the hot water, which is made alkaline by the use of suitable chemicals. The cans are then removed from the soaking tank and the interior of the can subjected to the spray action of a hose nozzle, and the exterior of the can to an ordinary shower sprayer. These sprayers are placed within metal housing.

The can washing equipment is shown on United States Standard Garbage Can Washing Plan No. 414. 43-130, in the files of the Construction Division.

and all joints level. All joints should be filled with the mortar to be used. Where the nature of the work warrants a special kind of brick or material, the kind of material, method of laying, bonding and joining, should be noted on the drawings.

HOLLOW TILE AND FLUE LININGS.

All hollow building tile used should be hard burned and free from serious warp. Cracks in tiles not affecting their usefulness may be permitted. All tile should be laid true and plumb, with full mortar joints and well bonded. Anchorage of frames or rough wood backs should be made with bolts, anchors, or large spikes as the case may require and such anchors should occur at tile joints. Lintels should be made of reinforced concrete or reinforcing rods inserted in the core of the tile and filled with Portland cement as detailed. Hollow tile walls are used where specially called for, in hospital construction, warehouses, fire-stops, etc. Flues in brick chimneys should be lined with hard burned terra cotta flue linings of sizes shown on drawings.

CLEANING AND POINTING.

On completion of the structures, all masonry work should be cleaned, patched and repointed in a suitable manner.

EXTERIOR CEMENT PLASTER AND STUCCO.

For further details as to cement stucco, reference may be made to the standard specifications of "American Concrete Institute for Stucco on Wood and Metal Lath."

All plaster and stucco should be mixed in wood boxes and not on the ground.

Exterior stucco on lath should be applied over approved galvanized wire cloth, or No. 24 gauge coated or painted expanded metal lath or ribbed lath, weighing not less than 3¼ lbs. per square yard. Where lathing is secured directly to the studding, the studding or nailing should be spaced not over 16 inches on centers, 12 inches preferred, and the lathing should be lapped at least 1 inch at joints. First coat should be composed of one part Portland cement to three parts sharp sand, with ten per cent hydrated lime added, and a sufficient amount of cattle hair or fiber to secure a good clinch. This coat should extend beyond the face of lath at least ¼ inch. While still green, follow with the second coat made of same material as first coat, less the hair or fiber, and to be at least ⅜ inch thick. The second coat may be smooth, trowled or sand-floated. In case a rough-cast finish is required, a special mix of materials will be necessary, to suit the texture of surface required. Where stucco is applied to hollow tile or brick, the surfaces should be uniformly wet and the same materials and number of coats used as above-mentioned for metal lath.

INSIDE CEMENT PLASTER.

All inside cement plaster work should be done in the same manner as exterior cement plaster work, except that in every case the finished surfaces should be smooth trowled. For hospital construction, the finish coat of shower-bath walls should be at least ¼ inch thick of an approved highly calcined gypsum product that, when completed, will not be affected by water.

INSIDE WALL PLASTER.

Wall plaster may be any approved high grade wall plaster and in general should be shipped neat, for the addition of not more than two parts of sharp, coarse sand, by weight. The wall

plaster should be put on in two coats in the same manner as exterior cement plaster work. Where white coating is especially required, this finish should be made of well-slaked, screened lime putty, gauged with gypsum calcined plaster, and should be thoroughly troweled on. For hospital construction, plaster fire walls both sides, also all rooms having cement floors.

Note: Plaster grounds, of nominal thickness, should be used as follows: ⅝ inch for brickwork or tile or for metal lath, and ⅞ inch for plaster board ⅜ inch thick.

FIBER WALL BOARD.

General Use: Fiber wall board is a finish for walls, ceilings and partitions on the interior of temporary buildings.

Composition: It should consist of thin sheets or slabs of one or more piles of wood fiber, or equivalent, combined with an adhesive or sizing and formed with smooth surfaces.

Thickness: Should average 3/16 inch with a tolerance of 1/32 inch minus.

Widths: Should be 32 and 48 inches with a tolerance of 1/16 inch plus or minus.

Lengths: Should be 8, 9, 10 and 12 feet with a tolerance of ¼ inch plus or minus.

Weight: Including the surface coatings, should average 500 lbs. per 1,000 sq. ft. with a tolerance of 5 per cent plus or minus.

Texture: Boards should be free from splits, blisters and imperfections of a harmful character. They should be smooth, and capable of receiving the ordinary forms of interior decorative paint coatings.

Application: The boards should run, as far as is practicable, in single lengths between stories. They should be secured by nailing with flat head nails, spaced about 8 inches apart and to studs spaced not over 2 feet apart. The joints where it is considered necessary, may be covered, the common practice in such case being to use strips about 3/16 inch by 1⅜ inches, secured with nails spaced not more than 12 inches apart.

GYPSUM WALL BOARD.

General Use: Gypsum wall board is a finish for walls, ceilings and partitions on the interior of temporary buildings. It should consist of thin sheets or slabs, composed of a core of fibered hydrated gypsum plaster and a surfacing of chip or manila board on both sides. This material is not readily flammable and does not carry or communicate fire. It is designed to receive the ordinary forms of interior decorative paint and will not receive plaster coatings.

Thickness: Should be ⅜ inch with a toleratolerance of ⅜ inch plus or minus.

Widths: Should be 31¾ and 47¾ inches with a tolerance of 1/16 inch plus or minus.

Lengths: Should be 8, 9 and 10 feet with a tolerance ⅜ inch plus or minus.

Note: Unless otherwise specially stated, boards of the widths named above and in lengths of 4, 5, 6 and 7 feet, in amount not exceeding 5 per cent, may be included.

Weight: Should be not less than 1,750 lbs., nor more than 2,000 lbs. per 1,000 sq. ft. of board.

Finished Product: The surface exposed after erection, should be true and free from imperfections that will render the boards unfit for use with or without decorations.

Application: Should be in general compliance with methods previously described under heading of "Fiber Wall Board," except that in hospital construction all joints may be filled with plaster or covered with adhesive tape as required.

GYPSUM PLASTER BOARD.

General Use: Gypsum plaster board is used as a base for gypsum plaster finish on the interior of buildings. It is a similar material to that previously described for gypsum wall board, the surface sizing being omitted.

Thickness: Should be ⅜ inch with a tolerance of 1/16 inch plus or minus.

Width: Should be 32 inches with a tolerance of ¼ inch minus.

Lengths: Should be 36 and 48 inches with a tolerance of ½ inch plus or minus.

Note: Unless otherwise specially stated, boards of the widths named above and in lengths of 18, 24 and 30 inches, in amount not exceeding 5 per cent, may be included.

Weight: Should be not less than 1,500 lbs., nor more than 1,900 lbs. per 1,000 sq. ft. of plaster board.

Finished Product: The surfaces should be free from cracks or serious imperfections. Boards having corners burred or broken and not affecting the surface beyond 1½ inches may be used.

Application: Should be in general compliance with methods described for gypsum wall board, using large-headed nails spaced not to exceed 6 inches.

ROOFING.

Preparation: All roof-surfaces should be made as smooth as is practicable to receive the roofing.

Temporary Buildings: For these buildings, the incline of roofs should be in general, not less than 3 inches to the foot, horizontal. For roofs of such buildings, where incline is 3 inches or more per foot, there should be used what is known as three-ply prepared roofing. The average life of such roofing is about five years. This material is technically rag felt, saturated and coated with asphalt. For its application there should be furnished with the roofing, all necessary nails and cement. The roofing should be lapped 3 inches at horizontal joints, cemented thoroughly between laps and nailed every 3 inches. Nailing should begin at center of sheet and nail toward ends. Care should be taken to have vertical joints lap at least 6 inches, carefully cementing and nailing as described for horizontal joints.

Note: For vertical covering of temporary buildings, where indicated on the drawings, the materials should be what is known as "two-ply prepared roofing," of similar character to the two ply roofing above described.

Warehouses, Etc.: These buildings are divided into two classes, temporary and permanent. For roofs of both classes of these buildings, the incline should be not more than 3 inches, nor less than ½ inch per foot, horizontal. For such temporary buildings there should be used what is generally known as three-ply built-up roofing. For such permanent buildings, there should be used what is generally known as five-ply built-up roofing. These roofs are composed of three or more layers of roofing felt, cemented together and coated with roofing cement and surfaced with gravel or crushed slag, or the equivalent. Such roofs may not be expected to require repairs or renewals for from 5 to 10 years for the three-ply roofing, or from 15 to 20 years for five-ply roofing.

Materials for Built-up Roofing: Sheathing paper should not weigh less than 5 lbs. per 100 sq. ft. with a tolerance of 4 per cent. Roofing felt composed of rag felt saturated with either coal-tar or asphalt, should be about 32 inches wide, and should not weigh less than 13½ lbs. per 100 sq. ft. with a tolerance of 7 per cent. Roofing cement should consist of either straight run coal tar pitch, or refined asphalt, to conform to the Standard Specifications, adopted for such material. The surfacing material should consist of clean gravel, crushed slag or stone, approximately ¼ to ⅝ inch in size, dry when laid and free from dirt.

Application of 3-Ply, Built-Up Roofing, Over Boards:

(1) Apply one layer of sheating paper next to the roof boards, lapping the sheets at least one inch, and nailing along the edges to hold in place until the felt is applied.

Note: When asphalt saturated felt and asphalt cement are used, the sheathing paper may be omitted.

(2) Apply three layers of roofing felt over the sheathing paper, lapping each sheet 22 inches over the preceding sheet.

(3) Mop each sheet about the full width of the lap, with roofing cement, using not less than 25 lbs. per 100 sq. ft. in each mopping between sheets.

(4) Nail each sheet along the longitudinal center line with broad-headed roofing nails, spaced not to exceed 36 inches.

(5) Over the felt thus laid, spread a uniform layer of roofing cement, using not less than 40 lbs. per 100 sq. ft.

(6) Into the roofing cement, while hot, imbed the surfacing material, using not less than 400 lbs. of gravel or 300 lbs. of crushed slag per 100 sq. ft.

Application of 3-Ply, Built-Up Roofing, Over Concrete:

(1) Mop the surface with a priming coat.

Note: When tar saturated felt and coal tar pitch are used, the priming coat is not required.

(2) Apply a uniform layer of roofing cement over the roof surface, using not less than 40 lbs. per 100 sq. ft.

(3) Apply three layers of roofing felt same as "(2) three-ply over boards."

(4) Mop each sheet same as "(3) three-ply over boards."

(5) On inclines exceeding one inch to the foot, nail each sheet similar to "(4) three-ply over boards."

(6) Over the felt, spread cement same as "(5) three-ply over boards."

(7) Surface with stone or gravel same as "(6) three-ply over boards."

Application of 5-Ply, Built-Up Roofing, Over Boards:

(1) Apply one layer of sheathing paper next to the roof boards, lapping the sheets at least one inch and nailing along the edges to hold in place until the felt is applied.

Note: When asphalt saturated felt and asphalt cement are used, the sheathing paper may be omitted.

(2) Apply two layers of roofing felt over the sheathing paper, lapping each sheet 17 inches over the preceding sheet.

(3) Nail sheets along edges sufficiently to hold in place, pending further application of felt layers.

(4) Mop the entire surface with roofing cement, using not less than 25 lbs. per 100 sq. ft., omitting the mopping between sheets.

(5) Apply three additional layers of roofing felt over the mopping of cement, lapping each sheet 22 inches over the preceding sheet.

(6) Nail each sheet along the longitudinal center line with broad-headed roofing nails, spaced not to exceed 36 inches.

(7) Mop each of the last three sheets the full width of the lap with roofing cement, using not less than 25 lbs. per 100 sq. ft., in each mopping between sheets.

(8) Over the felt, thus laid, spread a uniform layer of roofing cement, using not less than 65 lbs. per 100 sq. ft.

Note: If preferred, the two lower sheets of felt may be cemented together, using 25 lbs. of roofing cement per 100 sq. ft. and the 25 lbs. thus used may be deducted from the quantity used on the surface, as above stated.

(9) Into the roofing cement, while hot, imbed the surfacing material, using not less than 400 lbs. of gravel or 300 lbs. of crushed slag per 100 sq. ft.

Application of 5-Ply, Built-Up Roofing, Over Concrete:

(1) Mop the surface with a priming coat.

Note: When tar-saturated felt and coal-tar pitch are used, the priming coat is not required.

(2) Apply a uniform layer of roofing cement over the roof surface, using not less than 40 lbs. per 100 sq. ft.

(3) Apply two layers of roofing felt, lapping each sheet 17 inches over the preceding sheet.

(4) Mop each sheet the full width of the lap with roofing cement, using not less than 25 lbs. per 100 sq. ft. in the mopping between sheets.

(5) Mop the entire surface with roofing cement, using not less than 25 lbs. per 100 sq. ft.

(6) Apply three aditional layers of roofing felt over the mopping of cement, lapping each sheet 22 inches over the preceding sheet.

(7) On inclines exceeding one inch to the foot, nail each sheet along the longitudinal center line with broad-headed roofing nails, spaced not to exceed 36 inches.

(8) Mop each of the last three sheets the full width of the lap with roofing cement, using not less than 25 lbs. per 100 sq. ft. in each mopping between sheets.

(9) Over the felt thus laid, spread a uniform layer of roofing cement, using not less than 40 lbs. per 100 sq. ft.

(10) Surface in stone or gravel same as "(9) five-ply over boards."

Flashings and Trimmings: Metal cap flashings and felt base flashings should be used for temporary work. 16-oz. copper base and cap flashings are preferable for permanent work but under war emergency conditions this metal is not always available and an approximate substitute should be used.

Twenty-six gauge galvanized steel is recommended for flashings in temporary work. If this metal is not available, sheet zinc equal in thickness to twenty-six gauge may be substituted.

Felt base flashings should be formed by extending the roofing felt and cement up the wall at least 6 inches and fastening the top to the wall with nails. The metal cap flashings should be set or cemented into the wall and extended down over the base flashings to the surface of the roof covering.

The gravel stops at roof edges and gutter-heads should be of metal and incorporated with the felt and cement.

SHEET METAL WORK.

Preliminary: The following provisions are meant to apply in general, to the temporary emergency work. In cases of permanent buildings the choice of materials and methods of construction should, as nearly as is possible, approximate peace-time standards.

Note: For metal flashings, etc., see *Flashings and Trimmings.*

Gutters and Leaders: Where especially shown on the drawings or required, they should be of 26-gauge galvanized steel. Gutters should be graded to leaders and supported by metal hangers or brackets, spaced not over 2 feet apart.

The leaders should be of ample size for the removal of roof water and may be round or rectangular, preferably corrugated, and equipped with the necessary turns to conduct water to grade or to the sewers. The leaders should be secured to walls by iron hold-fasts or sheet-metal strips.

Note: For sizes of pipe and for roof drainage areas, etc., see "Piping," under heading of "Plumbing," included in this Manual.

Ventilators: In general, for roofs, should be of galvanized steel. For capacities and details, see Drawing No. 620-325, in the files of the Construction Division.

Corrugated Steel, where used for side walls or roof coverings, should be No. 26 gauge for walls and No. 21 gauge for roofs, and should be galvanized. Where it is necessary to use steel that is not galvanized, it should be well-coated both sides with paint. The steel should lap at least 1 inch at the vertical joints and at least 2 inches at the horizontal joints. Rivets should be spaced not to exceed 12 inches.

Painting: Sheet metal surfaces should be painted as follows: All metals subject to rust, all concealed surfaces of tin or galvanized steel, flashings and siding. The paint used should be red lead and linseed oil, and at least one good coat should be applied.

SKYLIGHTS.

For temporary construction, skylights should be made of wood and flashed with metal, in general, similar to detail included in this Manual for warehouse roofs (Plate 111). They should be provided with condensation gutters with weep holes, rod reinforcements and such flashings as may be needed for the construction.

Glass, for skylights in the temporary construction, unless otherwise shown on the drawings, should be ribbed and not less than ¼ inch thick. For the more permanent construction, the glass should be ribbed and wired, not less than ¼ inch thick. All glass should be well-bedded in putty and made thoroughly water-tight.

WOOD FRAMING.

Materials: Framing lumber should be of sound merchantable yellow pine or fir. Other timber of equivalent strength may be used. Timber should be of dimensions generally given on the drawings, and planing of same is to reduce dimensions not more than 3/16 inch for one side planing, nor more than 3/8 inch for two-side planing.

Foundation Posts—Footings: Foundation posts shown of wood, may be of chestnut, cypress or cedar, round or square, or any available wood or tree cuttings, of equal strength. Posts should not be less than 8 inches in diameter nor less than 6 inches square. Under the wood posts, the footings are generally formed of concrete or flat stones. The footings should be well bedded in place. All wood below ground should be well creosoted.

Wood Posts: Wood foundation posts shall be used for buildings of a temporary character only, where it is believed the building will not be required for longer than two years, otherwise, piers shall be built in lieu thereof.

Sills and Girders, should be built up construction rather than single sections. Joints of the built-up sections should be staggered over bearings and the pieces should be spiked together at least once every foot, using nails of length approximately equal to thickness of the two pieces.

Studding: Outside and inside studding is generally figured on the drawings, and should be doubled at sides of wide openings, and trebled at corners. Braces should be cut in at outside corners, and wherever necessary to relieve weight over wide openings. Provide all necessary blocking for nailings of every description.

Joist, should be set with crowding side up. They should be spaced as shown, doubled around stair walls, under partitions and under stove locations. Bridge through center of spans with pieces of same section as joist, or cross bridging as shown or required.

Bracing: During construction, temporary bracing should be provided to hold all work in place until it is self-supporting. In general, bracing for frame structures is shown on the drawings, and care should be taken that a thorough system of bracing is maintained throughout the entire structure. Brace foundation posts to girders and to joist, joist to studding, rafters to studding and to collar beams or ties, and posts to girders. Partitions in frame buildings may be considered as adequate bracing.

Trusses and Rafters: In the construction of trusses for temporary construction, for spans of 36 feet or less, truss members should be spiked rather than bolted together, as shown on Plate 60. All truss members should be accurately fitted and framed, bolting, spiking or otherwise securing together as shown on the details. The lower chord of trusses should be crowned 1 inch for each 25 feet of span. All rafters should be accurately spaced in reference to unit dimensions and doubled around roof openings 4 feet or more in width. At rafters and roof trusses, knee and wind bracing should be carefully constructed.

Framing and Nailing: In the construction of typical frame buildings, all of the members should be well spiked together. Special framing should only apply to structures detailed for particular construction, and drawings in such cases should be carefully observed. For all nailed up construction, care should be taken that the strength of nails or spikes equals the stresses of members so joined.

Siding, Under Floors, Roofing Boards, should be yellow pine, fir, or equivalent wood, 1 inch by 4 to 12 inches wide. This material should be double nailed for boards 6 to 8 inches wide; tripled nailed for boards 9 to 12 inches wide. For hospital construction, sheathing should be used instead of the boarding; the sheathing to be 13/16 inch by 6 to 8 inches, D. & M., sound pine. For Southern standard Cantonment construction, inside exposed face of boarding, should be dressed. Attention is directed to the essential difference between Northern and Southern standard Cantonment construction. In Southern Construction, excepting hospitals, all dead spaces are eliminated, in so far as this conforms to the methods shown on the

drawings. Note that by this method, in Southern Construction, wall board may be substituted for wood sheathing, under the drop siding. See details on Plates 46, 47 and 48. For under flooring of temporary construction, the boards should run at right angles to the joists. Spaces between floor and grade in all buildings should be made tight with studding and boards. See: "Provisions for Fire Prevention."

Drop Siding: Where Novelty or Drop Siding, or Ship Lap is shown, it should be of yellow pine or fir, or equivalent wood, 13/16 inch by 6 to 8 inches wide. Siding should be double nailed not to exceed 24 inches apart.

Two Ply Covering and Battens: For description of one ply prepared roofing, see paragraph "Temporary Buildings" under heading of "Roofing."

Where shown on the drawings for temporary buildings, the vertical surfaces should be covered with the above mentioned material. It should run vertically and at joints lapped at least 2 inches. Cover the joints thus formed with vertical battens about 1 inch by 2 inches and repeat battens at intermediate points. The battens should be nailed at least once every 8 inches.

Sheathing, for inside walls and partitions should be of yellow pine or fir or equivalent wood, dressed and matched (D. & M.) not less than 7/16 inch nor more than ⅞ inch thick. Note that partitions for Southern Camp and Cantonment Construction are sheathed on one side only.

Finished Flooring: All interior floors, unless otherwise shown on the drawings, are to be double. The finished flooring is to be flat grain No. 1 common yellow pine, or No. 3 N. C. Pine, except where especially mentioned to be otherwise, 13/16 inch thick by not more than 5¾ inches wide. The flooring is to be laid at right angles to under floor, for temporary construction, blind nailed at least once in every 2 feet and for the more permanent construction, blind nailed once in every 16 inches. Boards over 4½ inches wide are to be top-nailed in addition to blind nailing. Between floors insert one thickness of building paper, lapping edges and with tight joint at walls. Porch floors are to be 13/16 inch by 3¼ inches, D. & M., of fir or rift grain yellow pine, with white leaded joints and blind nailed. For hospital construction, under flooring is to be 13/16 inch by 6 to 8 inch, D. & M., sound pine with two nails at each bearing. Finished flooring is to be 13/16 inch by 3¼ inches D. & M., No. 1, flat grain N. C. pine, laid at right angle to the under flooring and blind nailed at least once in every 16 inches.

Draft Stops: In hospital construction, at an intermediate point between the floors, draft stops should be cut in between the studding. Draft stops and divisions for concealed spaces should be generally provided as shown on the drawings or as described under heading: "Provisions for Fire Prevention." Draft stops between first floor and grade should be constructed of 2-inch by 4-inch studs and two thicknesses of ⅞-inch D. & M. boards. Draft stops between ceiling and roof should be constructed of 2-inch by 4-inch studs, with plaster board on both sides. In hospital construction, the above described draft stops should be not more than 50 feet apart, or as noted on the drawings.

Building Paper, between floors and under drop-siding, may be any suitable commercial building paper of adequate weight, water proofed for hospital construction and where especially called for.

Insulation, where especially called for, is to be approved flax fiber, of thickness shown on the drawings.

CARPENTRY AND MILLWORK.

Finish in General: For standard Cantonment Buildings, the carpentry and mill-work should be pine, fir, or cypress, of simple character, in general conformity with the plates included in this Manual, which methods are standard for this type of work only. For Hospital Construc-

tion, the wood finish should be of No. 1 yellow pine or fir, according to the details generally shown on drawing Z-1. Carpentry and mill-work for other types of buildings should be in general conformity with "Standard Specifications—Details for War Buillding Projects," prepared under the auspices of the War Industries Board, Building Materials Division, also Carpentry.

Panel Doors, should be of pine, cypress, fir or spruce (Oregon or Washington), No. 1 grade for natural finish and No. 2 grade for paint. Doors may be 4 or 5 panel, moulded O. G., B. & C. or C. & B. Panels may be flat or raised.

Sash Doors, should be of the same materials as panel doors with 1, 2, 4 or 6 lights of single strength B grade glass, set with best quality commercial putty.

Batten Doors, should be of sound quality wood for painting, built of 13/16 inch T. & G. material with 13/16 inch framing on both sides. Framing should consist of 7½ inch stiles and top rails, 11½ inch bottom rails, 5½ inch cross rails and 4½ inch diagonal rails. For hospital construction, note fire doors of two thicknesses of sheathing and which should be provided with hardware required by the details.

Exterior Door and Window Frames, should be of sound quality wood for painting, and should conform in details to the required thickness and construction of the walls. Window frames for temporary construction in general should be of the horizontal sliding type, see Plate 54. Double sliding frames are only used incidentally for this type of construction, see Plate 55. Double sliding plank frames are generally used for hospital construction and where especially shown on the drawings; the frames should be provided with weight boxes for future weights.

Window Sash and Transoms, should be of white pine. Glass in general should be of single strength B grade, well tacked in place and set with best quality commercial putty. Glass of special kind, quality and thickness is noted on the drawings.

Stairs, should be constructed on 2 inch by 12 inch carriages not over 2 feet apart, blocked apart at least once between floors. Treads should be 1 and 1/16 inches thick and risers 13/16 inches thick, of yellow pine, housed together, the treads in general square edge for Standard Cantonment Construction. Wall rails should be turned, or not less than 1⅝ inches by 2¾ inches with rounded corners, as the case may require, well secured to walls with suitable wood or steel brackets not more than 6 feet apart. Rise for stairs in general, should not exceed 8 inches. For hospital construction, rise for stairs should not exceed 7½ inches and the run of the tread not less than 10 inches. These provisions should apply to outside stairs as well, except that no risers are required. Ladders should be provided where shown on the drawings of 2 inch by 4 inch stringers and 1 inch by 3 inch rungs and should be well secured to walls.

PAINTING.

Painting should be done only when specifically authorized, the general policy for temporary building, being not to paint. All materials for paint, varnishes, etc., when used, and the mixing thereof, should conform strictly to "Standard Specifications for War Building Projects." For hospital construction, all doors and windows before glazing, should be primed. Paint all exterior hospital wood and metal work, one coat light gray in color, covering capacity 200 sq. ft. per gallon. Paint all interior hospital wood finish two coats. Size and paint one coat all plaster walls of hospitals. Paint operating wing throughout and in addition paint two coats with best enameled paint.

Note: See also "Painting" under heading "Sheet Metal Work."

Painting Pipes: Pipes serving various purposes should be identified by means of bands painted thereon. The bands are to be 4 inches wide and should be located near valves or joints. Wherever practicable the operating engineer of the plant should be consulted as to location of bands.

The colors used for the bands should be as follows:

High pressure steam pipes	Black
Low pressure steam pipes	Buff
Fire lines	Red
Water lines	Green
Compressed air pipes	Blue
Electric conduits	White

HARDWARE FOR STANDARD CANTONMENT BUILDINGS AND HOSPITALS.

Note: Hardware should conform to "Standard Specifications and Details for War Building Projects," prepared under the auspices of the War Industries Board, Building Materials Division. The principal hardware items in use for temporary construction are given by W. I. B. plate number and description as follows:

Locks for Outside Doors, W. I. B. (Plate 1F):

Three tumbler Easy Spring Locks, Brass face, strike and bolts, case not less than 3½ by 3¼ inches with 2½ inch backset. Two N. P. steel keys for each lock. Wrought brass knobs, 2¼ inch one piece spheroid pattern, secured by side know screws and plain spindles. Wrought brass escutcheons 6 by 2 inches for both sides of door.

Note: In addition to the lockset specified, provide for each rear or basement entrance door one mortise bolt.

Note: For cantonment work substitute steel where brass is specified.

Locks for Inside Doors, W. I. B. (Plate 3-E):
Rim knob locks, upright type, japanned iron case, not less than 4 by 3¼ inch iron bolts; iron key; pottery knobs; japanned shanks; japanned iron rose and key plate.

Butt Hinges for Outside and Inside Doors, W. I. B. (Plate 5-B):
Plated wrought steel, 3½ by 3½ inch, 2 to each door. For doors opening into baths, to be sherardized or electro-galvanized before plating.

Spring Butt Hinges for Single and Double Acting Doors, W. I. B. (Plate 5-J & K):
For single-acting doors, plated wrought steel, required size.
For double-acting doors, plated wrought steel, required size.

Butt Hinges for Transoms Over Interior Doors W. I. B. (Plate 5-G):
Plated wrought steel, 2½ by 2½ inch.

Spring Hinges for W. C. Doors, W. I. B. (Plate 5-L):
Japanned wrought steel, size 3 by 3 inches.

Door Bolts, W. I. B. (Plate 7-J):
Japanned wrought steel, polished bolt, with screws, required size. (Sizes 2½, 3, 4, 5, 6, 8 inch.)

Spring Bolts for Windows, W. I. B. (Plate 9-G):
Steel, galvanized or tinned.

Transom Chain, W. I. B. (Plate 8-E):
Wrought steel, 12 inch.

Transom Catch, W. I. B. (Plate 8-H):
Plated cast iron or wrought steel, 1¼ by 2¼ inch.

Screen Door Hardware:
Iron wire hook and eye, pull and "Perfect" spring, all japanned.

HARDWARE FOR FIRE ENGINE HOUSES, STABLES AND WAREHOUSES.

Swinging Doors: Screw, hook and strap hinges, 18 inch to 36 inch as required, three to each door, japanned.

Top and bottom bolts, 10 inches long, extra strong, japanned, W. I. B. (Plate 7-C & F), japanned cast iron or wrought steel required size, top bolt with chain of required length.

Warehouse Sliding Doors: Trolleys and tracks of adequate sizes, guides, rollers and stops. 2 inch cast bronze padlocks with 4 levers and 2 keys to each.

Hitching Rings: 2½ inch rings with screw eyes.

Swing Bar Chains: 2 foot halter chain with screw-eye and S-hook.

SCREENS:

For hospital construction, there should be provided full length removable screens for all doors and windows that are not protected by screened porches; also screens for all porches including screen doors for same. Wire for screens should be No. 16 and galvanized.

CANTONMENT BUILDINGS.

PRELIMINARY.

The office of the Advisory Architect is charged primarily with responsibility for the design of the various structures, used for housing troops and animals, in camps and posts. It determines the types of buildings necessary under existing conditions and the sizes required to accommodate the various military organizations. It also passes on the necessity of additional construction for which requests are received, recommending authorization where this is warranted by the evidence presented. Drawings prepared in the field for additional structures, when suitable, are frequently accepted for use without change; otherwise they may become the basis for revision directed from this office.

Building locations selected by a constructing officer (subject to the approval of the Commanding Officer of the Camp or Post), should be submitted to the Washington office for final approval.

Permanent post buildings are not included in the following considerations as they are usually based on standards laid down by regulations and custom.

Drawings for temporary buildings have been standardized and such modifications as are necessary to fit any given site are, to a large extent, determined in the field.

The sizes of the cantonments required for housing the troops mobilized in the fall of 1917, was such that the use of two-story barracks had to be resorted to, in order to conserve not only the ground space, but also the extent of roads, sewers, water pipes and electric lines necessary to serve them. The original cantonment buildings were designed for use only in the far south. These have been modified for use in the northern states, where heating is necessary during the winter months.

Materials and construction methods for the Standard temporary buildings, are described under heading "Construction Notes," included in this Manual.

GENERAL CONSIDERATIONS

In designing Standard temporary buildings, consideration has been given:

(a) to the utilization of commercial lengths of lumber without waste;

(b) the reduction to a minimum the number of pieces of lumber of different dimensions;

(c) the avoidance of excessive spans requiring large sizes of timber;

This policy resulted in the adoption of a standard width of 20 feet, with 7 foot bays, for one-story buildings; and widths of 30 to 42 feet, with bays of 8 or 10 feet, for two-story buildings; each building being of such number of bays as is necessary to give the requisite capacity.

In order to simplify manufacture and to facilitate packing, transportation, sorting and erection, sash of six 10 by 15 inch lights, and doors 2 feet 8 inches by 6 feet 8 inches, have been adopted.

The considerations in paragraphs above apply particularly to Standard types of temporary buildings used as living quarters, mess halls, lavatories, storehouses and other buildings, that occur in considerable numbers in a cantonment. The same principles are not always applicable to buildings designed for very special purposes. Such special buildings occur singly or in small numbers only, and do not therefore interfere with the systematic progress of large group construction.

The cantonment barracks were originally planned to provide an entire company organization with sleeping and messing space. Later developments pointed to the desirability of providing space for smaller groups of men. The present practice is to provide dormitories for from 30 to 35 men, using two-story buildings, in which the second stories are accessible only from the outside; mess halls being provided in separate buildings.

The practice of the War Department requires the provision of 60 square feet of floor space or 720 cubic feet of air space, for each man in barrack dormitories in permanent buildings. The earliest cantonment drawings provided 36 square feet and 360 cubic feet, on the supposition that, as these buildings were to be used in a semi-tropical climate, the windows and doors would all be open and the buildings would be so far from air-tight that ample ventilation would be available. In the temporary buildings now in use, which are designed to be heated, the allowance is 50 square feet of floor space and 500 cubic feet of air space for each man.

PORTABLE BUILDINGS.

Unit Construction.

DRAWINGS AND CONSIDERATIONS.

The use of the portable type of building has proved advantageous in some cases, where scarcity of labor and speed of erection were factors.

Standard drawings are available in the Construction Division for "Portable Buildings," as follows:

Key plans—one and two-story buildings 20 feet and 28 feet wide, respectively..... 411.4-100

One-story buildings, 20 feet wide..... 411.4-101

Two-story buildings, 28 feet wide..... 411.4-102

Framing pieces (details)..... 411.4-103

The above drawings contain all necessary details for manufacture, marking and erection.

The available designs for portable buildings are composite, being formed from an analysis of the designs of a number of manufacturers, and they embody the best features of each. The resultant designs were checked by the manufacturers' engineers.

For efficient use of this type of construction, it is essential to maintain careful supervision over product at factory, shipping provisions and storage at job. Provisions should be made to insure interchangeability of parts from various factories, and a careful marking system should be adopted.

The trial assembly of each type of building at factory, should be required before shipment of materials is begun. Parts exposed to the weather should receive one coat of paint before shipment.

Complete bills of material and lists of parts have been prepared in connection with these drawings, which will be of considerable assistance in checking and storing material, and for erection in the field.

Preliminary to the adoption of the portable type of construction, for a particular project, the relative advantages as compared with ordinary construction should be given careful consideration. In this connection, the following points, among others, should be considered:

(a) Methods of heating and suitability to northern and southern requirements;

(b) Length of haul between available factories and site;

(c) Ability of available factories to produce in sufficient quantities, within necessary time limits;

(d) Capacity limitations of one-story construction, and possible objections to two-story portable construction;

(e) Amount of repetition in identical building units;

(f) Possibility of future re-arrangement of buildings, with relation to each other; and the possibility of a change in location of an entire camp or portions thereof;

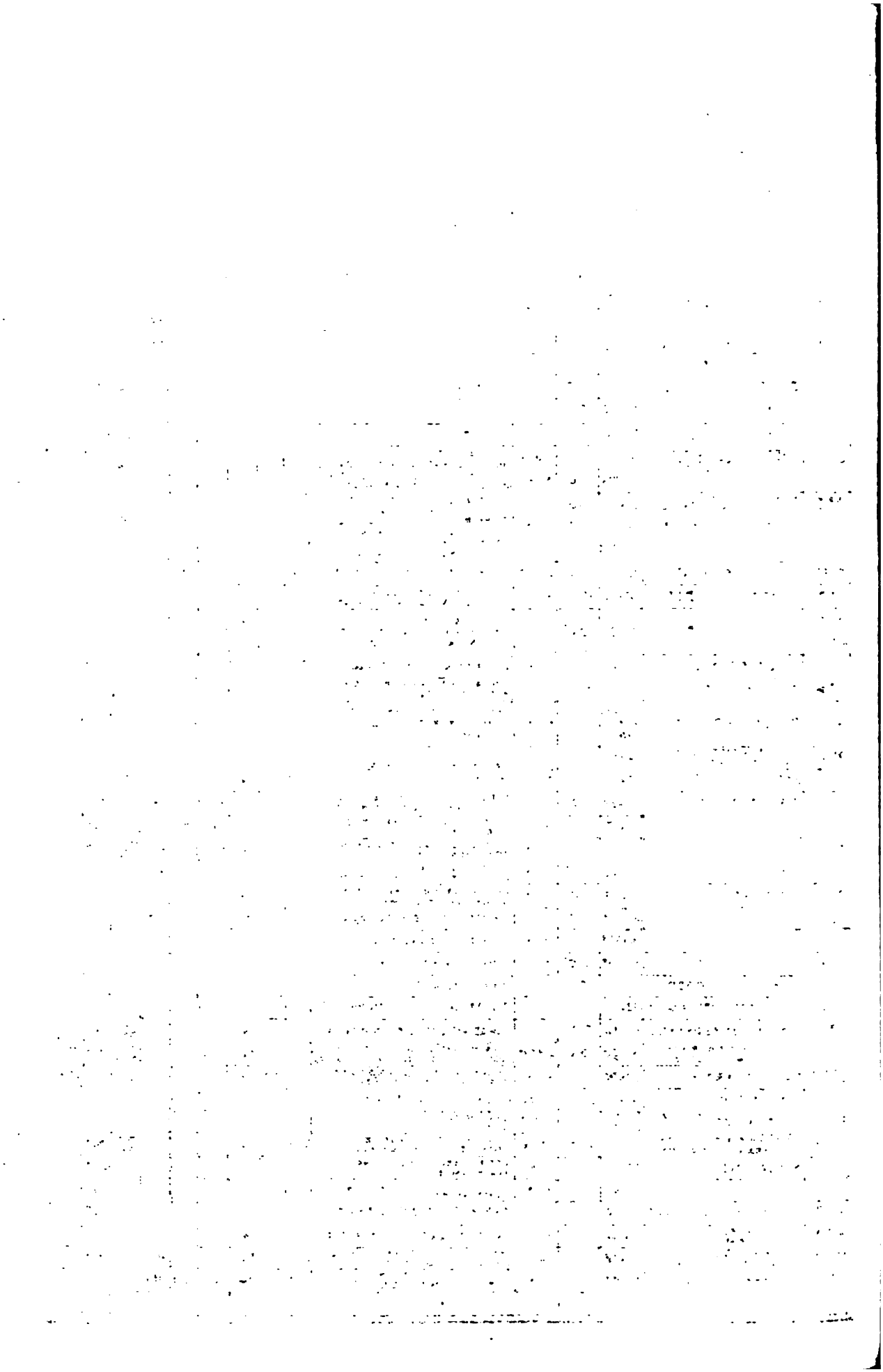
(g) Comparison of advantages where the remodelling or enlargement of buildings is contemplated;

(h) Established percentage to cover loss by breakage;

(i) Salvage probabilities in case of demolition.

JOB 620 TYPICAL BUILDINGS FOR CAMPS & CANTONMENTS
DESCRIPTION & REFERENCE DRAWINGS -

SHEET	NAME OF BUILDING	SIZE IN FEET	DEPTH	HEIGHT	NOTES UNLESS OTHERWISE NOTED ALL BLDGS ARE OF WOOD CONST.	CONST'N DETAILS		ELECT.	PLUMB	HOT W.	STEAM HEAT	STOVE HEAT	VENTS	MISC.
327	ADMINISTRATION BLDG.	20'x84'	7'-0"	1-STORY	5 OFFICES	317		367				329 330	325	
356	" "	20'x49'	7'-0"	" "	3 "	317		367				329 330	325	
397	AUTO & MOTOR SERVICE STA	35'x41'		" "	OFFICE & STORAGE - 12'x35' CORRUGATED STEEL ROOF & SIDING	314		367						
340	BAKERY - 1 OVEN	30'x70'	14'-0"	" "	1 OVEN - CAP. 6000 MEN - 24 HRS.	314		367	352	351			315	
428	" 1 "	30'x50'		" "	1 " " 3500 " " "	314		367	352	351			315	
379	" 3 "	40'x136'		" "	3 " " 25000 TO 35000 " "		361 362	367	352 420		460		315	
361-362	" 4 " ELL	40'x136' 51'x62'	10'-0"	" "	4 " " 40,000 TO 50,000 " "			367	352 420		460		315	
505	" 2 " ADD'N	33'x51'		" "	2 " ADD'N - 20,000 MEN " "									
313	BARRACK	30'x60'	10'-0"	2-STORY	66 MEN	314		367			476	329 330	325	
342	"	30'x50'	10'-0"	" "	52 "	314		367				329 330	325	
366	"	30'x40'	10'-0"	" "	40 "	314		367				329 330	325	
353	BARRACK DETACHMENT {WITHOUT MESS	20'xVAR	7'-0"	1-STORY	TYPE A - OFFICE & SERGT ROOM 14 MEN - 20'x49' TO 61 MEN - 20'x168'	317		367				329 330	325	
	" "	20'xVAR	7'-0"	" "	TYPE B - WITHOUT OFFICES ETC. 8 MEN - 20'x21' TO 56 MEN - 20'x140'									
355	BARRACK DETACAMENT {WITH MESS	20'xVAR	7'-0"	" "	TYPE A - 8 MEN 20'x35' TO 12 " 20'x42'	317		367	352			329 330	325	
	" " "	20'xVAR	7'-0"	" "	TYPE B - 17 " 20'x63' TO 24 " 20'x84'									
	" " "	20'xVAR	7'-0"	" "	TYPE C - 28 " 20'x105' TO 36 " 20'x126'									
457-456	BARRACK & LAVATORY	45'x120'	10'-0"	2-STORY	150 MEN - SHOWERS, W.C. - HEATER RM.	314	350	367		351		329 330	325	
450	CLASS ROOM BLDG.	30'x60'	10'-0"	" "	3 CLASS ROOMS 20'x30' ASSEMBLY RM. 30'x60' - CAP. 280	314		367				329 330	325	
469 & 470	CLASS ROOM BLDG	49'x130'	10'-0"	" "	6 CLASS ROOMS - 20'x30' ASSEMBLY ROOM - 49'x30' CAP 300 LECTURE ROOM 30'x49' " 200	334		367					325	
507	CLASS ROOM BLDG	30'x60'	10'-0"	" "	2 CLASS ROOMS 30'x60'	314		367				329 330	325	
336	BATH HOUSE	9'x6' TO 9'x32'	8'-0"	1-STORY	1 TO 40 MEN - 41 TO 80 MEN 81 " 160 - 161 - 240 "			367						
492	BOILER HOUSES	36'x31'x VAR. 46'x28' - - 11'x26' - -		" "	INDEPENDENT STEAM HEATING PLANTS FOR TYPICAL BUILDINGS.	317								STACK 330 OR 493
490-491	COFFEE ROASTING & GRINDING PLANT	26'x86'		" "	1 MACHINE - CAP. 4 BAGS PER HR. 60 BAGS PER 8 HOUR DAY			367					325	
326	DETENTION HUT	20'x20'		" "	8 MEN	317		367				329 330	325	
365	FIRE STATION	31'x86'	7'-0"	" "	TYPE A - 1 CAR - OFFICERS' CAR & QTRS 3 SERGTS. 1 LIEUT. DORM. 12 MEN.		341	367	420		443		325	
341	" "	24'x77'	7'-0"	" "	TYPE C - 1 CAR - 2 SERGTS. & DORMITORY - 12 MEN			367	420	351	443		325	
441	" "	31'x86'	7'-0"	" "	TYPE E - 2 CARS - OFF & 2 SERGTS. DORMITORY - 15 MEN.			367	420	351	475	329 330	325	
447	" "	31'x103'	7'-6"	" "	TYPE F - 2 CARS - 4 SERGTS. DORMITORY 18 MEN WITH MESS			367	352 420	351	475	329 330	325	
301	GARAGE	50'xVAR	10'-0"	" "	WITH REPAIR SHOP & WASH STANDS. HINGED DOORS TWO SIDES.			367						
322-323	"	65'x106'	18'-0"	" "	FOR STEAM HEATED BLDG. SEE 391			367						
511	"	30'xVAR	10'-0"	" "	HINGED DOORS ONE SIDE.			367						
524	" OPEN	50'xVAR	10'-0"	" "	USED FROM BOTH SIDES.									
525	" CLOSED	70'x180'	20'-0"	" "	SHOP 40'x70'									
496	" FOR AMBULANCES	22'x47'		" "	3 AMBULANCES & 2 MOTOR CYCLES									
331	GUARD HOUSE - REGIMENTAL	20'x56'	7'-0"	" "	GUARD RM - OFFICE - PRISONERS' RM.	317		367				329 330	325	
373	PRISONERS' BARRACK & YARD WITH FENCE	30'x90'	10'-0"	2-STORY	5 PRISONERS' DORMITORIES - 3 JINGLE CELLS OFFICE & MESS - LAV. DETACHED		314	367	352			329 330	325	SEE 394
373A	GUARD BARRACK	30'x90'	10'-0"	" "	1 DORM. 30'x90' 1 DORM 30'x30' SERGTS. OFF. & MESS - LAV. DETACHED.		314	367	352 847			329 330	325	394
378	HAY SHED	60'x165'	11'-9"	1-STORY	OPEN SHED - 70 TONS CAP. 500.									
445-446	HOSE HOUSE {TYPE A	6'x6'		8' HIGH	200' HOSE									
	" B	6'x7'		" "	200' "									
339	KITCHEN FOR DETENTION & QUARANTINE CAMPS	20'x40'	8'-0"	1-STORY	KITCHEN - 250 MEN RANGE. COOKS ROOM - STORE ROOM	317		367	352			329 330	325	
370	MAGAZINE	20'x20'		" "	CORR. STEEL ROOF & SIDING. PLATFORM BOTH ENDS.								325	
371	"	24'x60'		" "	" " BOTH SIDES. " "								325	
452	" BULLET-PROOF	10'x10'		" "	BRICK - CORR. STEEL ROOF								325	
429	MEAT INSPECTION PLATFORM	10'x66'		" "	2 OFFICES 10'x10' - OPEN PLATFORM			367						
307-308	INFIRMARY - DENTAL OPERATING BUILDING.	30'x88'	8'-0"	2-STORY	INFIRMARY 30'x48' - LAB. 12'x32' OPERATING ROOM - ETC.	305		367	352	351	415		325	
310-311	" - DORMITORY BLDG	30'x88'	8'-0"	" "	DORMITORY - 16 MEN - 14 BED ROOMS - MESS - ETC.	305		367	352	351	484		325	



JOB 620 TYPICAL BUILDINGS FOR CAMPS & CANTONMENTS
DESCRIPTION & REFERENCE DRAWINGS

SHEET	NAME OF BUILDING	SIZE IN FEET	DEPTH	HEIGHT	NOTES (UNLESS OTHERWISE NOTED ALL BLDGS ARE of WOOD CONST.)	CONST'N DETAILS	ELECT.	PLUMB.	HOT W.	STEAM HEAT	STOVE HEAT	VENTS	MISC.
302	INFIRMARY-MEDICAL	30x63	7'-0"	2 STORY	23 MEN & MESS (WAITING, EXAM., SURGEON'S ROOMS, DISPENSARY, DORMITORY, TOILETS, ETC)	305		367	352	351	426		325	
368-375	" "	30x77	7'-0"	" "	28 " " "	305		367	352	351	419		325	
382	" "	30x105		1-STORY	14 " " "	305		367	352	351	480		325	
383-384	" "	30x112	7'-0"	2-STORY	48 " " "	305		367	352	351	456		325	384
392-393	" "	30x96	7'-0"	" "	33 " " "	305		367	352	351	455		325	
449	" "	30x56		" "	14 " " "	305	334	367	352	351	481		325	
333	" ADDITION	24x34		1 "	6 " WITHOUT MESS			367					325	
324	LAVATORY {WITHOUT SHOWERS}	17'x14'		1-STORY	0 TO 80 MEN		350	367				329 330	325	
	" "	17x21		" "	80 " 160 "									
	" "	17x28		" "	160 " 250 "									
349	" WITH SHOWERS	14x14		" "	0 TO 20 MEN		350	367		351		329 330	325	
	" " "	14x20		" "	21 " 40 "									
348	" " "	20x21	7'-0"	" "	41 " 70 "		350	367		351		329 330	325	
	" " "	20x28		" "	71 " 100 "									
347	" " "	20x35	7'-0"	" "	101 " 140 "		350	367		351		329 330	325	
346	" " "	20x42	7'-0"	" "	141 " 190 "		350	367		351		329 330	325	
345	" " "	20x49	7'-0"	" "	191 " 250 "		350	367		351		329 330	325	
523	" " "	20x30		" "	191 TO 250 MEN {WITH OFF. TOILET SHOWER DR. RM.}									
335	LATRINE	12x8	8'-0	" "	1 TO 60 MEN			367						
	"	12x16		" "	61 " 90 "									
	"	12x16		" "	91 " 120 "									
	"	12x24		" "	121 " 180 "									
	"	12x24		" "	181 " 210 "									
	"	12x24		" "	211 " 250 "									
316	MESS BUILDING	20xVAR	7'-0"	" "	40 MEN 20x49 TO 296 MEN 20x175	317		367	352		ALSO 311	329 330	325	
442	" "	30x120	12'-0"	" "	250 MEN			367	352			329 330	325	
	" "	30x132		" "	300 "									
	" "	30x144		" "	350 "									
369	OFFICERS QUARTERS	20x21		" "	TYPE A - 2 OFFICERS WITH M.	317		367	352 420		461	329 330	325	
	" "	20x21		" "	" B 2 " WITH MESS									
	" "	20x21		" "	" C - 4 " WITHOUT "									
	" "	20x28		" "	" D - 3 " WITH "									
337	" "	20x49		" "	5 OFFICERS - WITH MESS	317		367	420		487	329 330	325	
343	" "	30xVAR	7'-0"	2-STORY	19 " 30x49 TO {WITHOUT 39 " 30x84 {MESS	314		367	420	351	462	329 330	325	
344	" "	20x28		1-STORY	1 " LIVING QUARTERS			367	352 420		465	329 330	325	
354	" "	30xVAR	7'-0"	2-STORY	19 " 30x63 TO {WITH 39 " 30x96 {MESS	314		367	420		463	329 330	325	
363	" "	20xVAR	7'-0"	1-STORY	10 TO 12 OFFICERS - 20x77 TO 18 - 20 " 20x119 - WITHOUT M.	317		367	420			329 330	325	
364	" "	20xVAR	7'-0"	" "	10 OFFICERS 20x96 TO {WITH 18 " 20x140 {MESS	317		367	352 420		466	329 330	325	
396	OIL HOUSE	20x30		" "	CORR. STEEL ROOF & SIDING								325	
508	ORDNANCE REPAIR SH.	30x106	11'-9"	" "	SHOP, STORAGE, CLEANING ROOM	314		367		351		328 330	325	
374	POSTOFFICE BUILDING	40x146	12'-0"	" "	PUBLIC SPACE, WORK RM, OUT & IN RMS.	314		367				329 330	325	
357	POST EXCHANGE	32x91	7'-0"	" "	STORE SPACE, OFFICE, SUPPLY RM, KITN	358 317		367	352			329 330	325	
359	QUARTERS FOR TELEPHONE OPERATORS	30x89	10'-0"	2-STORY	LIVING QUARTERS (FEMALE)	314		367	352	351	448	329 330	325	
488 & 489	RECRUIT EXAMINING BUILDING. (SHOP 509)	H FORM 135x192	7'-6"	" "	ROOMS FOR ADJ. G.O PERSONNEL " " MED. STAFF & QM STER. CAP. 1600 10 HOURS			367	527 528		527 528		325	
435	RENDERING PLANT	20'x72'	9'-0"	1 "	FOR RECLAMATION DIVISION FOR (GREASE)			367					325	
471-472	REFRIGERATING PLANT	32x48		2 "	TYPE F. CAPACITY 60 CATTLE PLATFORM ON 3 SIDES.			367						472 473
473	" COOLING TOWER					(SEE 471)								
507	SCHOOL BUILDINGS	30x60	10'-0"	2-STORY	2 CLASS ROOMS 30'x60'	314		367				329 330	325	

tion, the wood finish should be of No. 1 yellow pine or fir, according to the details generally shown on drawing Z-1. Carpentry and mill-work for other types of buildings should be in general conformity with "Standard Specifications—Details for War Buillding Projects," prepared under the auspices of the War Industries Board, Building Materials Division, also Carpentry.

Panel Doors, should be of pine, cypress, fir or spruce (Oregon or Washington), No. 1 grade for natural finish and No. 2 grade for paint. Doors may be 4 or 5 panel, moulded O. G., B. & C. or C. & B. Panels may be flat or raised.

Sash Doors, should be of the same materials as panel doors with 1, 2, 4 or 6 lights of single strength B grade glass, set with best quality commercial putty.

Batten Doors, should be of sound quality wood for painting, built of 13/16 inch T. & G. material with 13/16 inch framing on both sides. Framing should consist of 7½ inch stiles and top rails, 11½ inch bottom rails, 5½ inch cross rails and 4½ inch diagonal rails. For hospital construction, note fire doors of two thicknesses of sheathing and which should be provided with hardware required by the details.

Exterior Door and Window Frames, should be of sound quality wood for painting, and should conform in details to the required thickness and construction of the walls. Window frames for temporary construction in general should be of the horizontal sliding type, see Plate 54. Double sliding frames are only used incidentally for this type of construction, see Plate 55. Double sliding plank frames are generally used for hospital construction and where especially shown on the drawings; the frames should be provided with weight boxes for future weights.

Window Sash and Transoms, should be of white pine. Glass in general should be of single strength B grade, well tacked in place and set with best quality commercial putty. Glass of special kind, quality and thickness is noted on the drawings.

Stairs, should be constructed on 2 inch by 12 inch carriages not over 2 feet apart, blocked apart at least once between floors. Treads should be 1 and 1/16 inches thick and risers 13/16 inches thick, of yellow pine, housed together, the treads in general square edge for Standard Cantonment Construction. Wall rails should be turned, or not less than 1⅝ inches by 2¾ inches with rounded corners, as the case may require, well secured to walls with suitable wood or steel brackets not more than 6 feet apart. Rise for stairs in general, should not exceed 8 inches. For hospital construction, rise for stairs should not exceed 7½ inches and the run of the tread not less than 10 inches. These provisions should apply to outside stairs as well, except that no risers are required. Ladders should be provided where shown on the drawings of 2 inch by 4 inch stringers and 1 inch by 3 inch rungs and should be well secured to walls.

PAINTING.

Painting should be done only when specifically authorized, the general policy for temporary building, being not to paint. All materials for paint, varnishes, etc., when used, and the mixing thereof, should conform strictly to "Standard Specifications for War Building Projects." For hospital construction, all doors and windows before glazing, should be primed. Paint all exterior hospital wood and metal work, one coat light gray in color, covering capacity 200 sq. ft. per gallon. Paint all interior hospital wood finish two coats. Size and paint one coat all plaster walls of hospitals. Paint operating wing throughout and in addition paint two coats with best enameled paint.

Note: See also "Painting" under heading "Sheet Metal Work."

Painting Pipes: Pipes serving various purposes should be identified by means of bands painted thereon. The bands are to be 4 inches wide and should be located near valves or joints. Wherever practicable the operating engineer of the plant should be consulted as to location of bands.

The colors used for the bands should be as follows:

High pressure steam pipes	Black
Low pressure steam pipes	Buff
Fire lines	Red
Water lines	Green
Compressed air pipes	Blue
Electric conduits	White

HARDWARE FOR STANDARD CANTONMENT BUILDINGS AND HOSPITALS.

Note: Hardware should conform to "Standard Specifications and Details for War Building Projects," prepared under the auspices of the War Industries Board, Building Materials Division. The principal hardware items in use for temporary construction are given by W. I. B. plate number and description as follows:

Locks for Outside Doors, W. I. B. (Plate 1F):

Three tumbler Easy Spring Locks, Brass face, strike and bolts, case not less than 3½ by 3¼ inches with 2½ inch backset. Two N. P. steel keys for each lock. Wrought brass knobs, 2¼ inch one piece spheroid pattern, secured by side know screws and plain spindles. Wrought brass escutcheons 6 by 2 inches for both sides of door.

Note: In addition to the lockset specified, provide for each rear or basement entrance door one mortise bolt.

Note: For cantonment work substitute steel where brass is specified.

Locks for Inside Doors, W. I. B. (Plate 3-E):
Rim knob locks, upright type, japanned iron case, not less than 4 by 3¼ inch iron bolts; iron key; pottery knobs; japanned shanks; japanned iron rose and key plate.

Butt Hinges for Outside and Inside Doors, W. I. B. (Plate 5-B):
Plated wrought steel, 3½ by 3½ inch, 2 to each door. For doors opening into baths, to be sherardized or electro-galvanized before plating.

Spring Butt Hinges for Single and Double Acting Doors, W. I. B. (Plate 5-J & K):
For single-acting doors, plated wrought steel, required size.
For double-acting doors, plated wrought steel, required size.

Butt Hinges for Transoms Over Interior Doors W. I. B. (Plate 5-G):
Plated wrought steel, 2½ by 2½ inch.

Spring Hinges for W. C. Doors, W. I. B. (Plate 5-L):
Japanned wrought steel, size 3 by 3 inches.

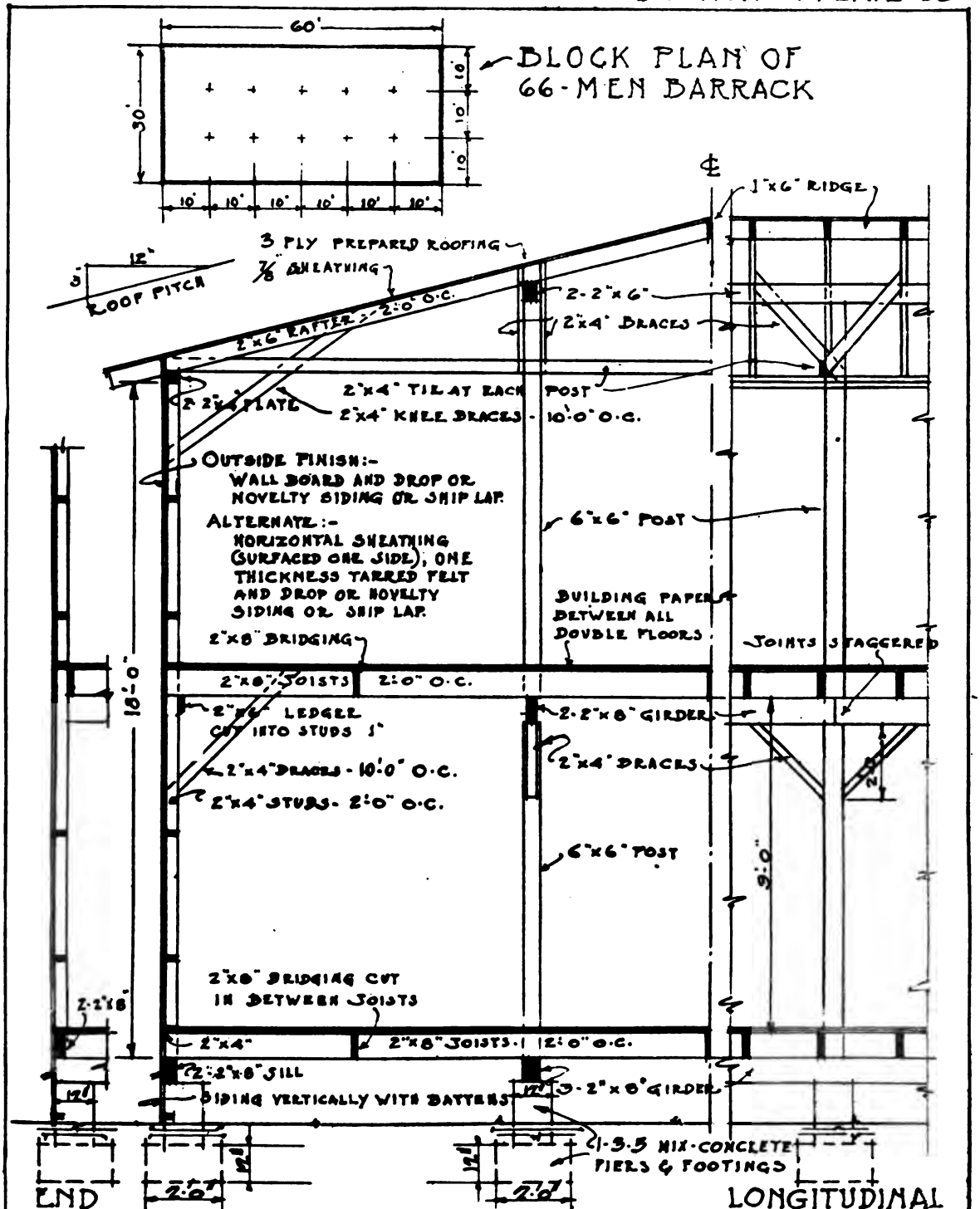
Door Bolts, W. I. B. (Plate 7-J):
Japanned wrought steel, polished bolt, with screws, required size. (Sizes 2½, 3, 4, 5, 6, 8 inch.)

Spring Bolts for Windows, W. I. B. (Plate 9-G):
Steel, galvanized or tinned.

Transom Chain, W. I. B. (Plate 8-E):
Wrought steel, 12 inch.

Transom Catch, W. I. B. (Plate 8-H):
Plated cast iron or wrought steel, 1¼ by 2¼ inch.

Screen Door Hardware:
Iron wire hook and eye, pull and "Perfect" spring, all japanned.



SOUTHERN · CONSTRUCTION

FOR DETAILS SEE DRAWINGS 620-313,314.5

CONSTRUCTION DIVISION OF THE ARMY

TYPICAL BUILDINGS

DETAILS · TWO STORY BUILDINGS

Key plans—one and two-story buildings 20 feet and 28 feet wide, respectively..... 411.4-100

One-story buildings, 20 feet wide..... 411.4-101

Two-story buildings, 28 feet wide..... 411.4-102

Framing pieces (details)..... 411.4-103

The above drawings contain all necessary details for manufacture, marking and erection.

The available designs for portable buildings are composite, being formed from an analysis of the designs of a number of manufacturers, and they embody the best features of each. The resultant designs were checked by the manufacturers' engineers.

For efficient use of this type of construction, it is essential to maintain careful supervision over product at factory, shipping provisions and storage at job. Provisions should be made to insure interchangeability of parts from various factories, and a careful marking system should be adopted.

The trial assembly of each type of building at factory, should be required before shipment of materials is begun. Parts exposed to the weather should receive one coat of paint before shipment.

Complete bills of material and lists of parts have been prepared in connection with these drawings, which will be of considerable assistance in checking and storing material, and for erection in the field.

Preliminary to the adoption of the portable type of construction, for a particular project, the relative advantages as compared with ordinary construction should be given careful consideration. In this connection, the following points, among others, should be considered:

(a) Methods of heating and suitability to northern and southern requirements;

(b) Length of haul between available factories and site;

(c) Ability of available factories to produce in sufficient quantities, within necessary time limits;

(d) Capacity limitations of one-story construction, and possible objections to two-story portable construction;

(e) Amount of repetition in identical building units;

(f) Possibility of future re-arrangement of buildings, with relation to each other; and the possibility of a change in location of an entire camp or portions thereof;

(g) Comparison of advantages where the remodelling or enlargement of buildings is contemplated;

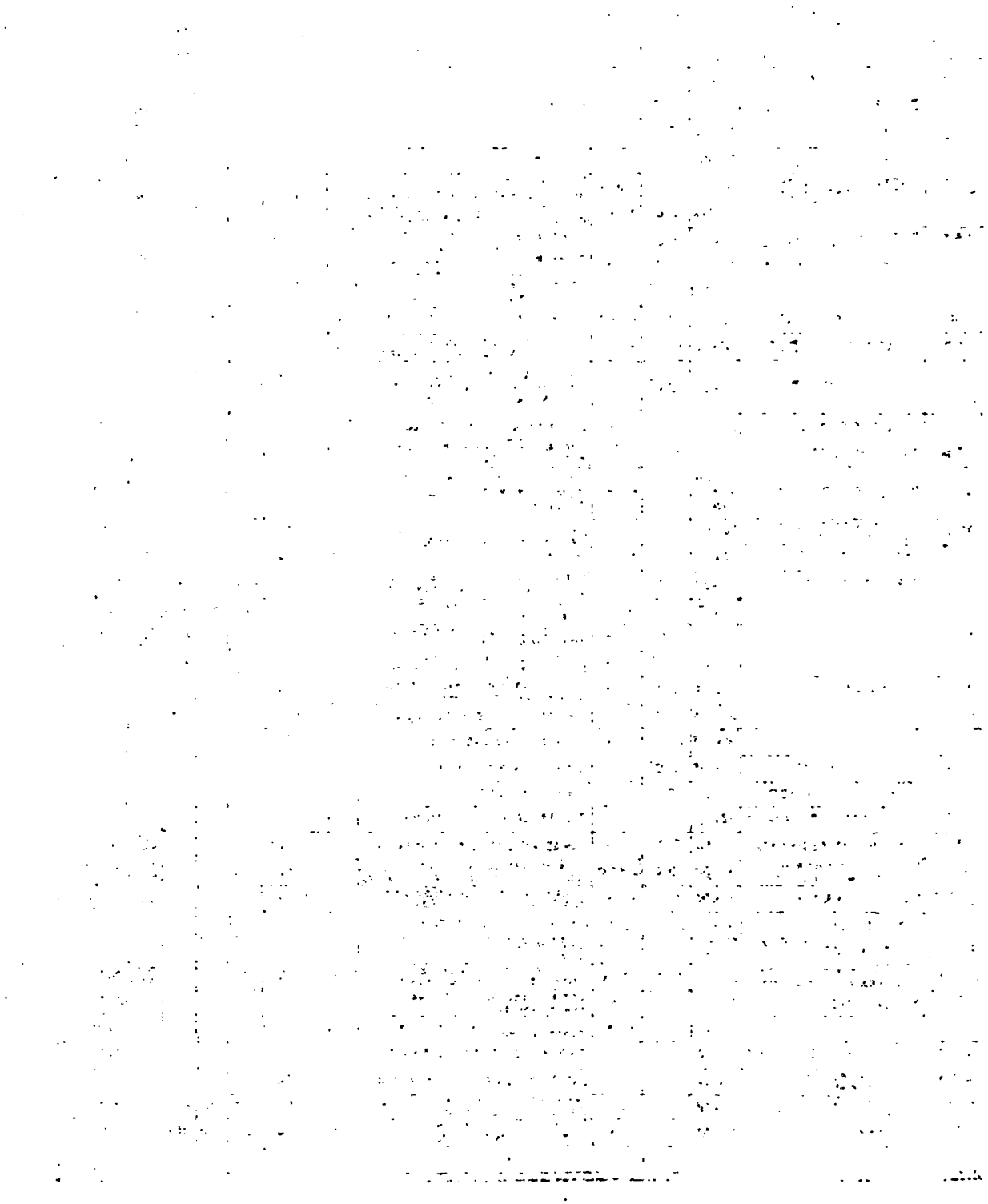
(h) Established percentage to cover loss by breakage;

(i) Salvage probabilities in case of demolition.

JOB 620

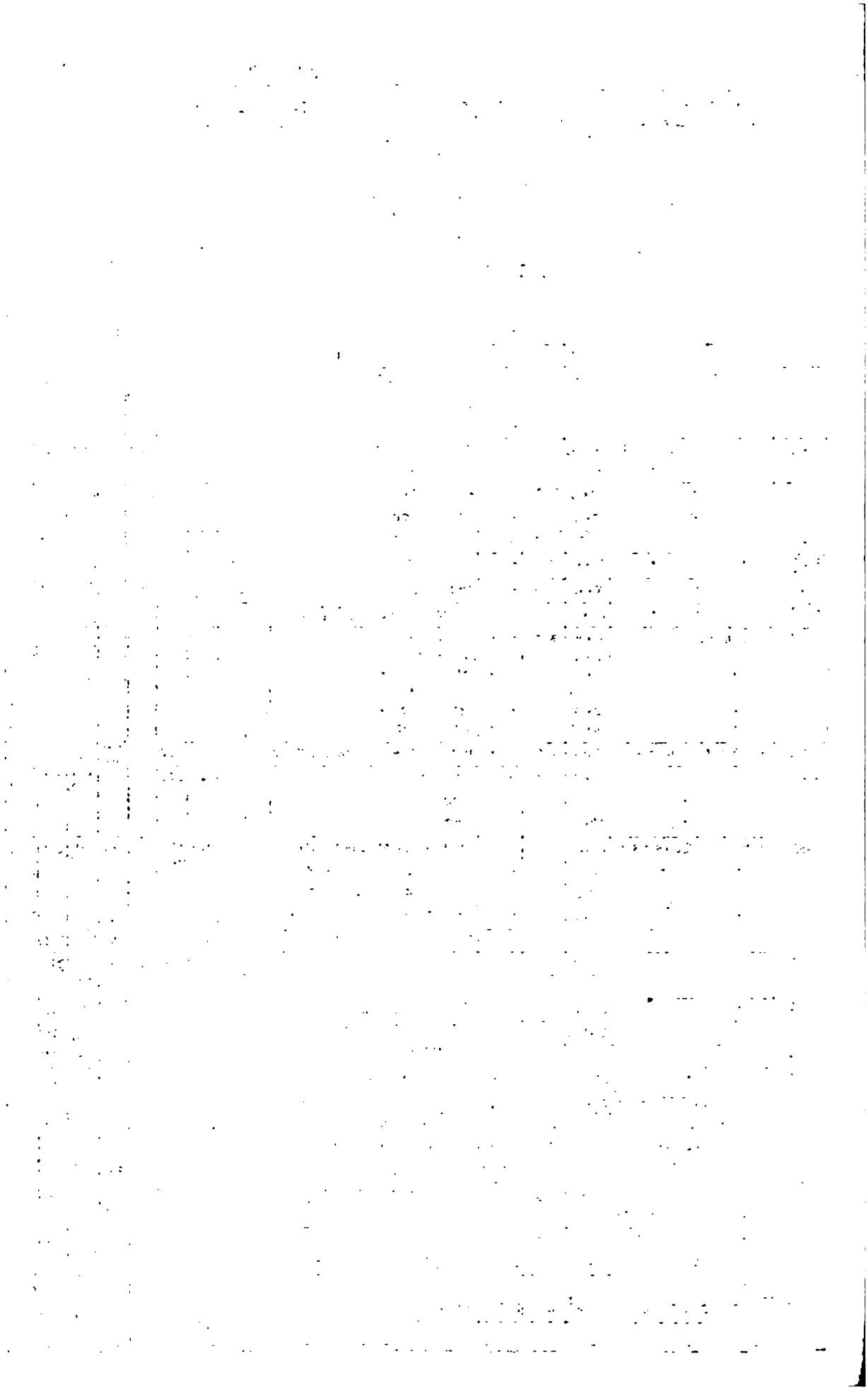
TYPICAL BUILDINGS FOR CAMPS & CANTONMENTS
DESCRIPTION & REFERENCE DRAWINGS.

SHEET	NAME OF BUILDING	SIZE IN FEET	BLT'D	HEIGHT	NOTES UNLESS OTHERWISE NOTED ALL BLDGS ARE OF WOOD CONST	CONST'N DETAILS		ELECT.	PLUMB	HOT W.	STEAM HEAT	STOVE PIPE	VENTS	MISC.
327	ADMINISTRATION BLDG.	20'×84'	7'-0"	1-STORY	5 OFFICES	317		367				329 330	325	
356	" "	20'×49'	7'-0"	" "	3 "	317		367				329 330	325	
397	AUTO & MOTOR SERVICE STA	35'×41'		" "	OFFICE & STORAGE · 12'×35' CORRUGATED STEEL ROOF & SIDING	314		367						
340	BAKERY · 1 OVEN	50'×70'	14'-0"	" "	1 OVEN · CAP. 6000 MEN · 24 HRS.	314		367	352	351			315	
428	" 1 "	30'×50'		" "	1 " " 3500 " " "	314		367	352	351			315	
379	" 3 "	40'×136'		" "	3 " " 25000 TO 35000 " "		361 362	367	352 420		460		315	
361-362	" 4 " ELL	40'×136' 51'×62'	10'-0"	" "	4 " " 40000 TO 50000 " "			367	352 420		460		315	
505	" 2 " ADD'N	35'×51'		" "	2 " ADD'N · 20000 MEN " "									
313	BARRACK	30'×60'	10'-0"	2-STORY	66 MEN	314		367			476	329 330	325	
342	"	30'×50'	10'-0"	" "	52 "	314		367				329 330	325	
366	"	30'×40'	10'-0"	" "	40 "	314		367				329 330	325	
353	BARRACK DETACHMENT { WITHOUT MESS	20'×VAR.	7'-0"	1-STORY	TYPE A - OFFICE & SERGT ROOM M MEN · 20'×49' TO 61 MEN · 20'×168'	317		367				329 330	325	
	" "	20'×VAR.	7'-0"	" "	TYPE B - WITHOUT OFFICES ETC. 6 MEN · 20'×21' TO 36 MEN · 20'×140'									
355	BARRACK DETACAMENT { WITH MESS ·	20'×VAR.	7'-0"	" "	TYPE A · 8 MEN 20'×35' TO 12 " 20'×42'	317		367	352			329 330	325	
	" " "	20'×VAR.	7'-0"	" "	TYPE B 17 " 20'×63' TO 24 " 20'×84'									
	" " "	20'×VAR.	7'-0"	" "	TYPE C · 28 " 20'×105' TO 36 " 20'×126'									
457-458	BARRACK & LAVATORY	45'×120'	10'-0"	2-STORY	150 MEN · SHOWERS, W.C. · HEATER RM	314	350	367		351		329 330	325	
450	CLASS ROOM BLDG.	30'×60'	10'-0"	" "	3 CLASS ROOMS 20'×30' ASSEMBLY RM. 30'×60' · CAP. 280.	314		367				329 330	325	
469 & 470	CLASS ROOM BLDG	49'×120'	10'-0"	" "	6 CLASS ROOMS · 20'×30' ASSEMBLY ROOM · 49'×90' CAP 900 LECTURE ROOM 30'×49' " 200	334		367					325	
507	CLASS ROOM BLDG	30'×60'	10'-0"	" "	2 CLASS ROOMS 30'×60'	314		367				329 330	325	
336	BATH HOUSE	9'×8' TO 9'×32'	8'-0"	1-STORY	1 TO 40 MEN · 41 TO 80 MEN 81 " 160 · 161 - 240 "			367						
492	BOILER HOUSES	30'×31'×VAR. 16'×28' " 11'×26' "		" "	INDEPENDENT STEAM HEATING PLANTS FOR TYPICAL BUILDINGS.	317								STACK 330 OR 495
490-491	COFFEE ROASTING & GRINDING PLANT	26'×86'		" "	1 MACHINE · CAP. 4 BAGS PER HR. [illegible]			367					325	
326	DETENTION HUT	20'×20'		" "	6 MEN	317		367				329 330	325	
365	FIRE STATION	31'×86'	7'-0"	" "	TYPE A · 1 CAR · OFFICERS' CAR & QTRS 3 SERGTS. 1 LIEUT · DORM. 12 MEN		341	367	420		443		325	
341	" "	24'×77'	7'-0"	" "	TYPE C · 1 CAR · 2 SERGTS. & DORMITORY · 12 MEN			367	420	351	443		325	
441	" "	31'×86'	7'-0"	" "	TYPE E · 2 CARS · OFF & 2 SERGTS. DORMITORY · 15 MEN.			367	420	351	475	329 330	325	
447	" "	31'×103'	7'-6"	" "	TYPE F · 2 CARS · 4 SERGTS. DORMITORY 18 MEN WITH MESS			367	352 420	351	475	329 330	325	
301	GARAGE	50'×VAR.	10'-0"	" "	WITH REPAIR SHOP & WASH STANDS. HINGED DOORS TWO SIDES.			367						
322-323	"	65'×100'	18'-0"	" "	FOR STEAM HEATED BLDG. SEE 301			367						
511	"	30'×VAR.	10'-0"	" "	HINGED DOORS ONE SIDE.			367						
524	" OPEN	50'×VAR.	10'-0"	" "	USED FROM BOTH SIDES.									
525	" CLOSED	70'×180'	20'-0"	" "	SHOP 40'×70'									
496	" FOR AMBULANCES	22'×47'		" "	3 AMBULANCES & 2 MOTOR CYCLES									
331	GUARD HOUSE · REGIMENTAL	20'×56'	7'-0"	" "	GUARD RM · OFFICE · PRISONERS' RM.	317		367				329 330	325	
373	PRISONERS' BARRACK & YARD WITH FENCE	30'×90'	10'-0"	2-STORY	3 PRISONERS' DORMITORIES · 3 SINGLE CELLS OFFICE & MESS · LAV. DETACHED		314	367	352			329 330	325	FENCE 394
373A	GUARD BARRACK	30'×90'	10'-0"	" "	1 DORM. 30'×90' 1 DORM 30'×30' SERGTS. OFF. & MESS · LAV. DETACHED.		314	367	352 847			329 330	325	394
378	HAY SHED	60'×165'	11'-9"	1-STORY	OPEN SHED · TONS CAP. 500.									
445-446	HOSE HOUSE { TYPE A	6'×7'		8½ HIGH	200' HOSE									
	" B	6'×7'		" "	200 "									
339	KITCHEN FOR DETENTION & QUARANTINE CAMPS	20'×40'	8'-0"	1-STORY	KITCHEN · 250 MEN RANGE. COOKS ROOM · STORE ROOM	317		367	352			329 330	325	
370	MAGAZINE	20'×20'		" "	CORR. STEEL ROOF & SIDING. PLATFORM BOTH ENDS.								325	
371	"	24'×60'		" "	PLATFORM BOTH SIDES. " "								325	
452	" BULLET-PROOF	10'×10'		" "	BRICK · CORR. STEEL ROOF								325	
429	MEAT INSPECTION PLATFORM	10'×66'		" "	2 OFFICES 10'×10' · OPEN PLATFORM			367						
307-308	INFIRMARY · DENTAL OPERATING BUILDING.	30'×86'	8'-0"	2-STORY	INFIRMARY 30'×48' LAB. 12'×32' OPERATING ROOM · ETC.	305		367	352	351	415		325	
310-311	" · DORMITORY BLDG	30'×86'	8'-0"	" "	DORMITORY · 16 MEN · 14 BED ROOMS · MESS · ETC.	305		367	352	351	486		325	



JOB 620 TYPICAL BUILDINGS FOR CAMPS & CANTONMENTS
DESCRIPTION & REFERENCE DRAWINGS

SHEET	NAME OF BUILDING	SIZE IN FEET	DEMTS	HEIGHT	NOTES (UNLESS OTHERWISE NOTED ALL BLDGS ARE OF WOOD CONST)	CONST'N DETAILS		ELECT	PLUMB	HOT W	STEAM HEAT	STOVE FLUE	VENTS	MISC
302	INFIRMARY-MEDICAL	30x65	7'-0"	2 STORY	23 MEN & MESS (WAITING, EXAM'N, SURG'L CONS'L ROOMS DISPENSARY, DORMITORY, TOILETS & ETC)	305		367	352	351	426		325	
368-375	" "	30x77	7'-0"	" "	28 " " "	305		367	352	351	419		325	
382	" "	30x105		1-STORY	14 " " "	305		367	352	351	480		325	
383-384	" "	30x112	7'-0"	2-STORY	48 " " "	305		367	352	351	456		325	384
392-393	" "	30x98	7'-0"	" "	33 " " "	305		367	352	351	455		325	
449	" "	30x56		" "	14 " " "	305	334	367	352	351	481		325	
333	" ADDITION	24x34		1 "	6 " WITHOUT MESS			367					325	
324	LAVATORY {WITHOUT SHOWERS}	17'x14'		1-STORY	0 TO 80 MEN		350	367				329 330	325	
	" "	17'x21'		" "	80 " 160 "									
	" "	17'x28'		" "	160 " 250 "									
349	" WITH SHOWERS	14'x14'		" "	0 TO 20 MEN		350	367		351		329 330	325	
	" " "	14'x20'		" "	21 " 40 "									
348	" " "	20'x21'	7'-0"	" "	41 " 70 "		350	367		351		329 330	325	
	" " "	20'x28'		" "	71 " 100 "									
347	" " "	20'x35'	7'-0"	" "	101 " 140 "		350	367		351		329 330	325	
346	" " "	20'x42'	7'-0"	" "	141 " 190 "		350	367		351		329 330	325	
345	" " "	20'x49'	7'-0"	" "	191 " 250 "		350	367		351		329 330	325	
523	" " "	20'x30'		" "	191 TO 250 MEN {WITH OFF. TOILET SHOWER DR. RM.}									
335	LATRINE	12'x8'	8'-0"	" "	1 TO 60 MEN			367						
	"	12'x16'		" "	61 " 90 "									
	"	12'x16'		" "	91 " 120 "									
	"	12'x24'		" "	121 " 180 "									
	"	12'x24'		" "	181 " 210 "									
	"	12'x24'		" "	211 " 250 "									
316	MESS BUILDING	20'xVAR	7'-0"	" "	40 MEN 20'x49 TO 296 MEN 20'x175	317		367	352		461 352	329 330	325	
442	" "	30'x120	12'-0"	" "	250 MEN			367	352			329 330	325	
	" "	30'x132		" "	300 "									
	" "	30'x144		" "	350 "									
369	OFFICERS QUARTERS	20'x21'		" "	TYPE A-2 OFFICERS WITH M.	317		367	352 420		461	329 330	325	
	" "	20'x21'		" "	" B-2 " WITH MESS									
	" "	20'x21'		" "	" C-4 " WITHOUT "									
	" "	20'x28'		" "	" D-3 " WITH "									
337	" "	20'x49'		" "	5 OFFICERS - WITH MESS	317		367	420		487	329 330	325	
343	" "	30'xVAR	7'-0"	2-STORY	19 " 30'x49 TO 30'x84 {WITHOUT MESS}	314		367	420	351	462	329 330	325	
344	" "	20'x28'		1-STORY	1 " LIVING QUARTERS			367	352 420		465	329 330	325	
354	" "	30'xVAR	7'-0"	2-STORY	19 " 30'x65 TO 30'x98 {WITH MESS}	314		367	420		463	329 330	325	
363	" "	20'xVAR	7'-0"	1-STORY	10 TO 12 OFFICERS - 20'x77 TO 16-20 " 20'x119 - WITHOUT M.	317		367	420			329 330	325	
364	" "	20'xVAR	7'-0"	" "	10 OFFICERS 20'x56 TO 18 " 20'x140 {WITH MESS}	317		367	352 420		466	329 330	325	
396	OIL HOUSE	20'x30'		" "	CORR. STEEL ROOF & SIDING								325	
508	ORDNANCE REPAIR SH.	30'x106'	11'-9"	" "	SHOP, STORAGE, CLEANING ROOM	314		367		351		329 330	325	
374	POSTOFFICE BUILDING	40'x148'	12'-0"	" "	PUBLIC SPACE, WORK RM, OUT & IN RMS	314		367				329 330	325	
357	POST EXCHANGE	32'x91'	7'-0"	" "	STORE SPACE, OFFICE, SUPPLY RM, KITC	358 317		367	352			329 330	325	
359	QUARTERS FOR TELEPHONE OPERATORS	30'x89'	10'-0"	2-STORY	LIVING QUARTERS (FEMALE)	314		367	352	351	448	329 330	325	
488 & 489	RECRUIT EXAMINING BUILDING. (SHOP 509)	H FORM 135'x192'	7'-6"	" "	ROOMS FOR ADJ G.O PERSONNEL " " MED. STAFF & CMSTER CAP. 1600 10 HOURS			367	527 528		527 528		325	
435	RENDERING PLANT	20'x72'	9'-0"	1 "	FOR RECLAMATION DIVISION FOR (GREASE)			367					325	
471-472	REFRIGERATING PLANT	32'x48'		2 "	TYPE F. CAPACITY 60 CATTLE PLATFORM ON 3 SIDES.			367						472, 473
473	" COOLING TOWER					(SEE 471)								
507	SCHOOL BUILDINGS	30'x60'	10'-0"	2-STORY	2 CLASS ROOMS 30'x60'	314		367				329 330	325	



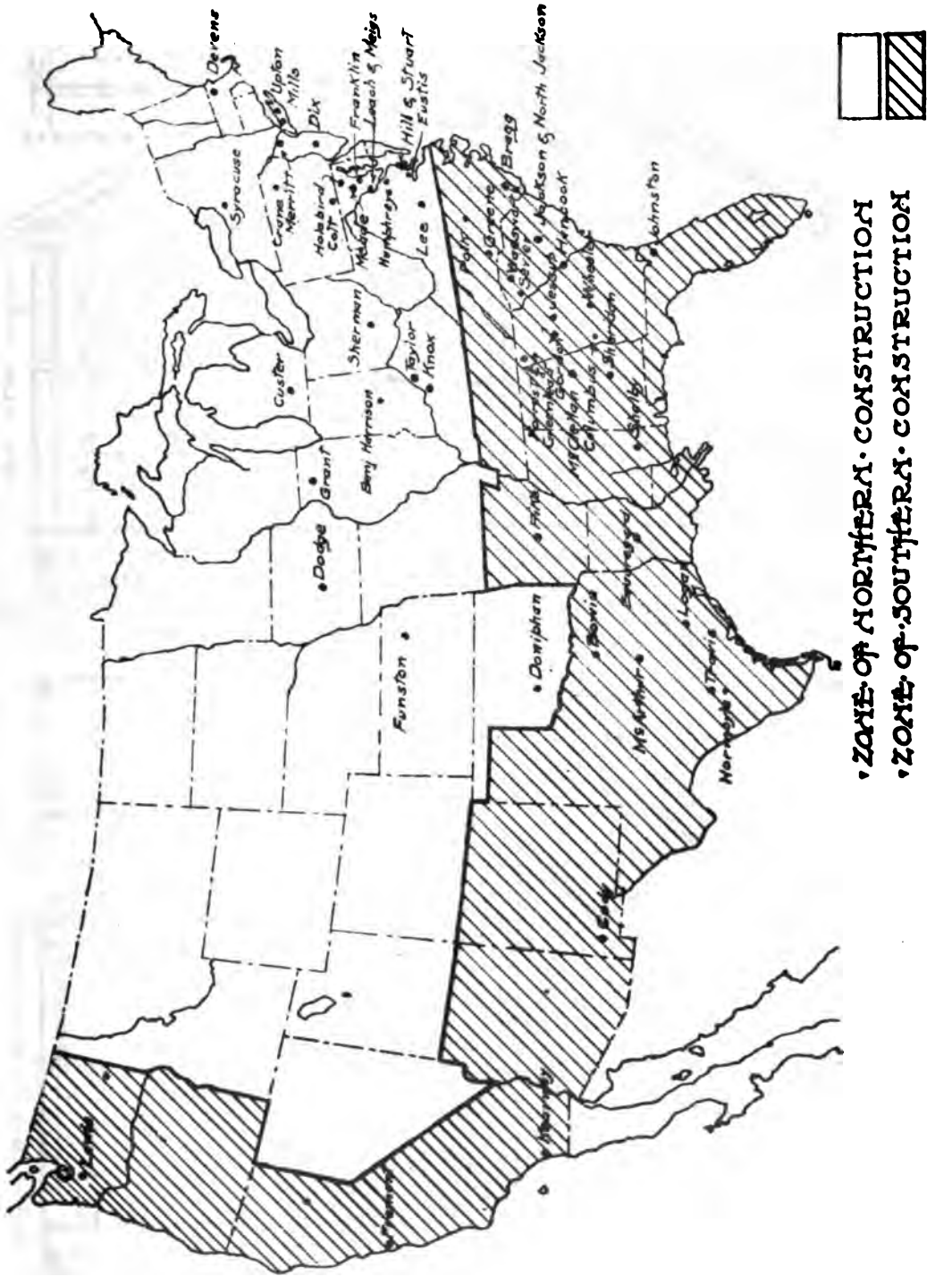
JOB 620

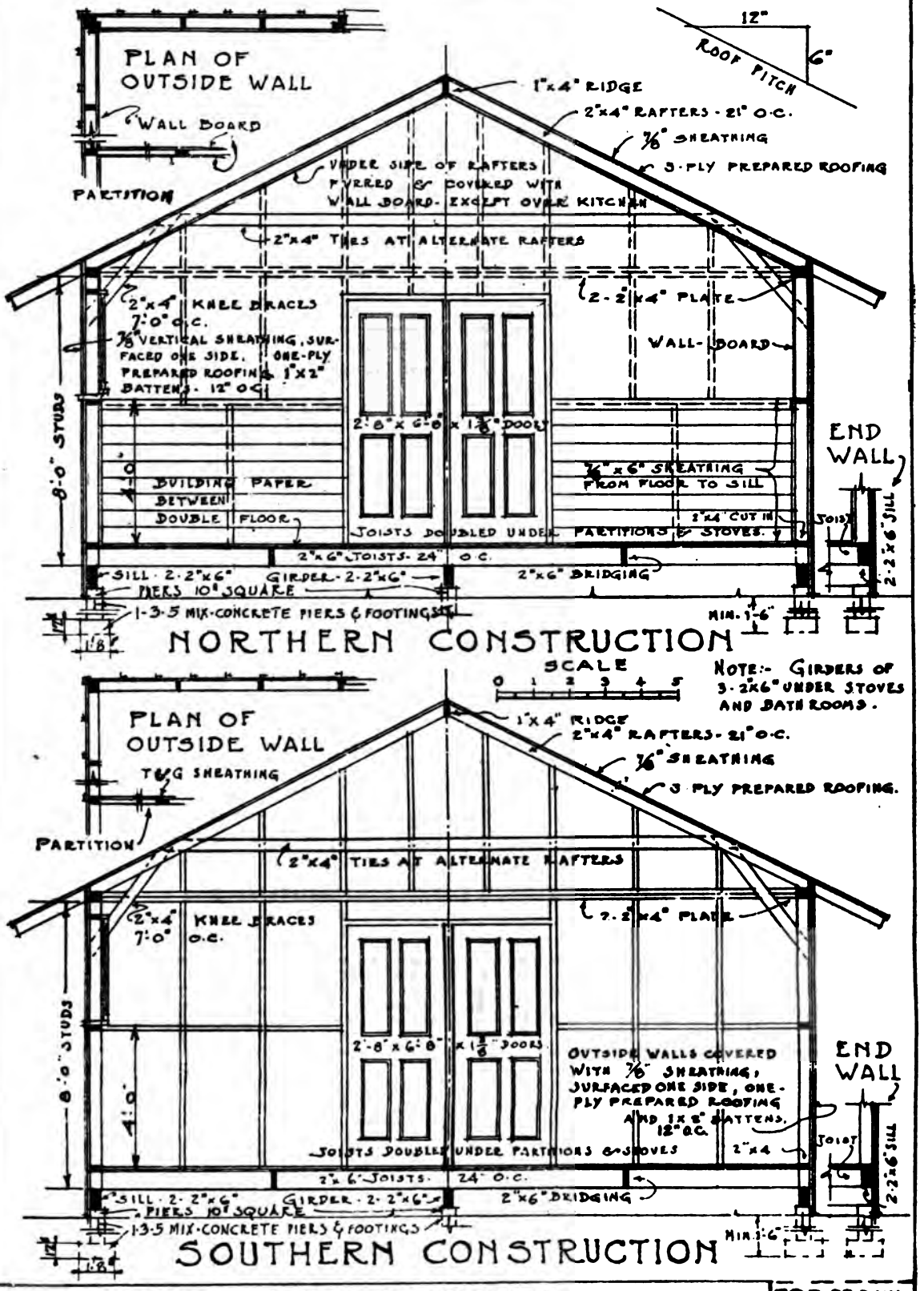
TYPICAL BUILDINGS FOR CAMPS & CANTONMENTS
DESCRIPTION & REFERENCE DRAWINGS

SHEET	NAME OF BUILDING	SIZE IN FEET	BENTS	HEIGHT	NOTES *UNLESS OTHERWISE NOTED ALL BLDGS ARE OF WOOD CONST.	CONST'N DETAILS		ELEC'T	PLUM'G	HOT W.	STEAM HEAT	STOVE HEAT	VENTS	MISC.
332	SHED · WAGON OR GUN	29'x VAR.	9'-0"	1-STORY	OPEN TWO SIDES									
372	SHOP	20'x36'	6'-0"	1 "		317		367				329 330	325	
381	" CLOTHING · SHOE REPAIR · PRINTING	30'x102'		1 "	STORE ROOMS & TOILETS.	314		367				329 330	325	
437	" CLOTHING SHOE & HAT REPAIR	60'x100'	10'-0"	2-STORY	" " " "	386	334	367			438	438A 329 330	325	
467	" CLOTHING REPAIR	28'x132'	10'-0"	1-STORY	STORE ROOMS	334		367			466		325	
	" CLOTHING AND HAT REPAIR	28'x162'	10'-0"	1 "	" "									
436	" COT REPAIR	40'x36'	10'-0"	1 "	WORK AND SUPPLY ROOMS.	334		367				329 330	325	
478-479	" MOTOR REPAIR	75'x96'	24'-0"	1 "	SHOP ROOMS INCLUDED.	484		367	352	351	485		325	
387-388	" " "	60'x130'	27'-4"	1 "	SHOP ROOMS INCLUDED	389	334	367			498		325	
390	" QUARTERMASTER - 2 BUILDINGS EACH	36'x106'	11'-9"	1 "	YARD BETWEEN BLDGS 40'x106'		334	367				329 330	325	
439	" TENT TREATING	36'x40'	10'-0"	1 "	WORK AND SUPPLY ROOMS.	334		367				329 330	325	
440	" " REPAIR	40'x60'	10'-0"	1 "	" " "	334		367				329 330	325	
395	SHOP	20'x VAR.	7'-0"	1 "		317		367				329 330	325	
451	SHOWER SHELTER & WASH HOUSE · (BATTALION)	20'x80'	8'-0"	1 "	MEN'S WASH, SHOWER & DRESSING ROOMS. OFFICER'S SHOWERS.	350		367		351		329 330	325	
	NORTHERN AND SOUTHERN CONSTRUCTION · · 320·2·182					ZONES MAP								
395	STABLE GUARD	20'x21'	7'-0"	1-STORY		317		367				329 330	325	
376	STABLE OPEN	24'x VAR.	10'-0"	1 "	4 ANIMALS TO EACH BENT.									
421	" · CLOSED	29'x VAR.	10'-0"	1 "	FORAGE AND SADDLE ROOMS.			367					325	
412-413	STORE HOUSE · SALVAGE	60'x160'	12'-0"	1 "	PLATFORM ONE SIDE.	413	334	367					325	
319	" " · DIVISIONAL	60'x165' UNITS	9'-8"	1 "	UNITS DIVIDED BY BRICK FIRE WALLS. 10' PLATFORM EACH SIDE			367						
482-483	" " · "	60'x160'	9'-9"	1 "	ONION & POTATO STORAGE · INSULATED. 10' PLATFORM EACH SIDE			367				329 330	325	
318	" " REGIMENTAL	20'x VAR.	7'-0"	1 "				367				329 330	325	
418	TEL. OFFICE & QUARTERS	20'x110'	10'-0"	1 "	TELEGRAPH OFFICE · 10 BED RMS DETACHED LAV · 14'x34'.	317	334	367	350	351	417		325	
328	TELEPHONE-TELEGRAPH BLDG	20'x70'	7'-0"	1 "	1 · ROOM EACH FOR OPERATOR · OPERATING · TERMINAL & TELEG. OFFICE	334		367			464	329 330	325	325
499-500	LIBERTY THEATRE	60'x120'	8'-0"	1 "	AUDITORIUM SEATING 1338. STAGE 30'x60' ADDED · SEE SHEETS 513.516.	400						503		325 367
385-386	WAREHOUSE FOR CLOTHING	60'x100'	10'-0"	2-STORY	2 OFFICES · TOILETS & ELEVATOR.	334		367					325	
432	WASTE & TRANSFER STA.	20'x130'	10'-0"	1-STORY	WASHING ROOM 20'x30' · OPEN PLATFORM 20'x100'			367	352	351				
473	WATER COOLING & CONDENSER	8'x25'		10 HIGH	ALSO TO BE BUILT IN CONNECTION WITH REFRIGERATOR PLAN	(SEE 471)								
325	VENTILATORS GALVANIZED STEEL				(FOR CAPACITIES, SCHEDULES & DETAILS)								325	

SCHEDULE FOR REMOUNT STATIONS.

DESCRIPTION	JOB 404	DESCRIPTION	JOB 404
PLAN FOR RIGGING AND CARGO CORRAL. CARGADOR'S SHOP AND PACK HOUSE.	23	TYPICAL RECEIVING CORRAL	36
CARGADO'R SHOP.	24	TYPICAL BLACKSMITH SCHOOL SHOP.	37
RIGGING AND CARGO CORRAL.	25	HAY RACK AND FEED TROUGH COMBINED	39
PACK HORSE FOR INSTRUCTION IN PACKING.	26	ANIMAL SHELTER.	42
HAY RACK AND FEED TROUGH.	27	OPERATION ROOM OR FORAGE ROOM.	43
TYPICAL FENCE AND GATE.	28	SHED FOR HAY CHOPPING AND OAT CRUSHING	44
COVERED CHUTE AND PEN.	29	TYPICAL OUTSIDE ELECTRIC WIRING PLNS	45
TYPICAL UNLOADING PLATFORM. PENS, GATES, CHUTES & RAMP	30 & 31	SHELTER SHED WITH HAY RACK & FEED TROUGH.	46
MANURE LOADING PLATFORM.	32	PLAN CHANGING LARGE CORRAL INTO (4) FOUR SMALLER CORRALS	47
DIPPING TANK.	33	STATION FOR 1500 ANIMALS.	48
BLACKSMITH AND WHEELWRIGHT SHOP.	34		
SHED FOR ISOLATION CORRAL.	35		


Devens
Upton
Mills
Dix
Franklin
Lewis & Meigs
Hill & Stuart
Eustis
Jackson & North Jackson
Bragg
Johnston
Syracuse
Crane
Hubbard
Cole
Hodge
Hemphreys
Lee
Pope
Taylor
Knox
Custer
Sherman
Grant
Dodge
Benj Harrison
Funston
Doniphan
McArthur
Norfolk
Thomas
Lewis
Davis
Sheridan
Clarke
Gordon
Columbus
Hancock
Wheeler
Taylor
Sevier
Polk
Greene
Haywood
Tipton
Shelby
Lauderdale
Obion
Weakley
Henry
Carroll
Benton
Humphreys
Perry
Hardin
Wayne
Decatur
Henderson
Chester
Madison
Crockett
Gibson
Dyer
Lake
Obion
Fulton
Hickman
Graves
Calloway
Marshall
Ballard
McCracken
Carlisle
Livingston
Crittenden
Union
Webster
Hopkins
Caldwell
Trigg
Lyon
Christian
Todd
Muhlenberg
Logan
Simpson
Warren
Butler
Ohio
Edmonson
Hart
Barren
Metcalfe
Monroe
Allen

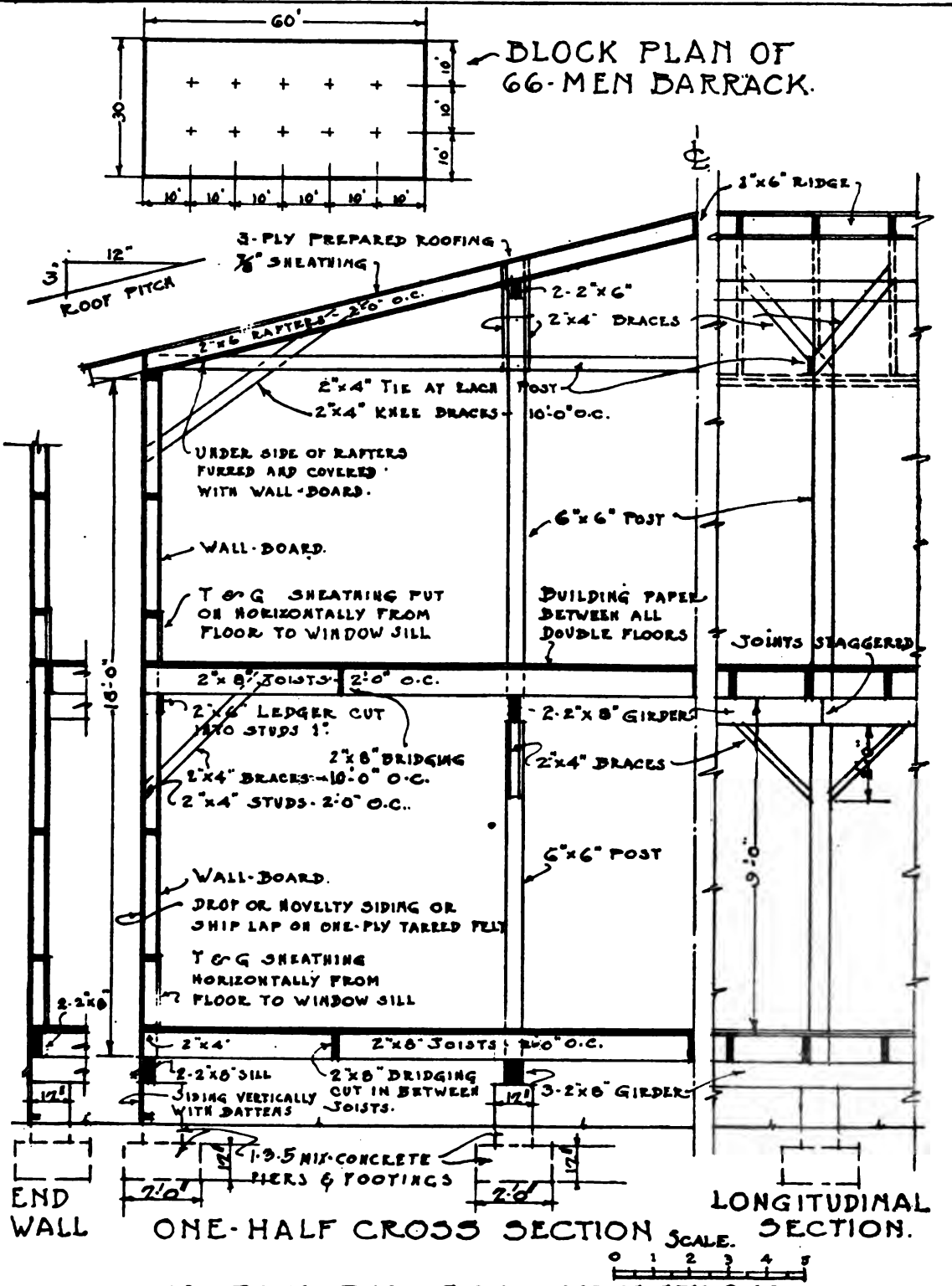


CONSTRUCTION DIVISION OF THE ARMY

TYPICAL BUILDINGS

DETAILS · ONE STORY BUILDINGS

FOR ORIGINAL SEE DRAWINGS 620-317 N, 317B



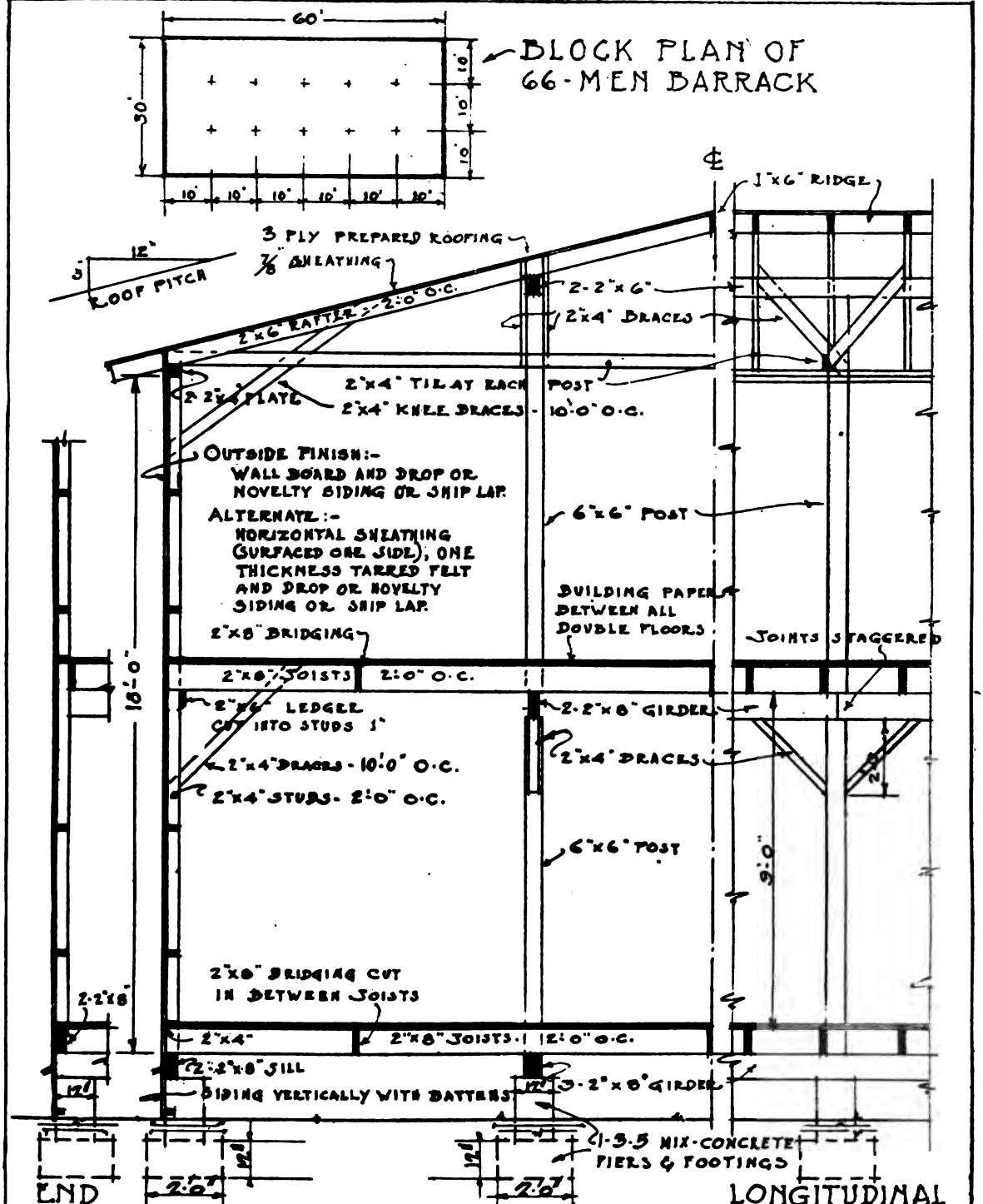
NORTHERN CONSTRUCTION

FOR ORIGINAL SEE DRAWINGS 620-313.314.11

CONSTRUCTION DIVISION OF THE ARMY

TYPICAL BUILDINGS

DETAILS · TWO STORY · BUILDINGS



SOUTHERN · CONSTRUCTION

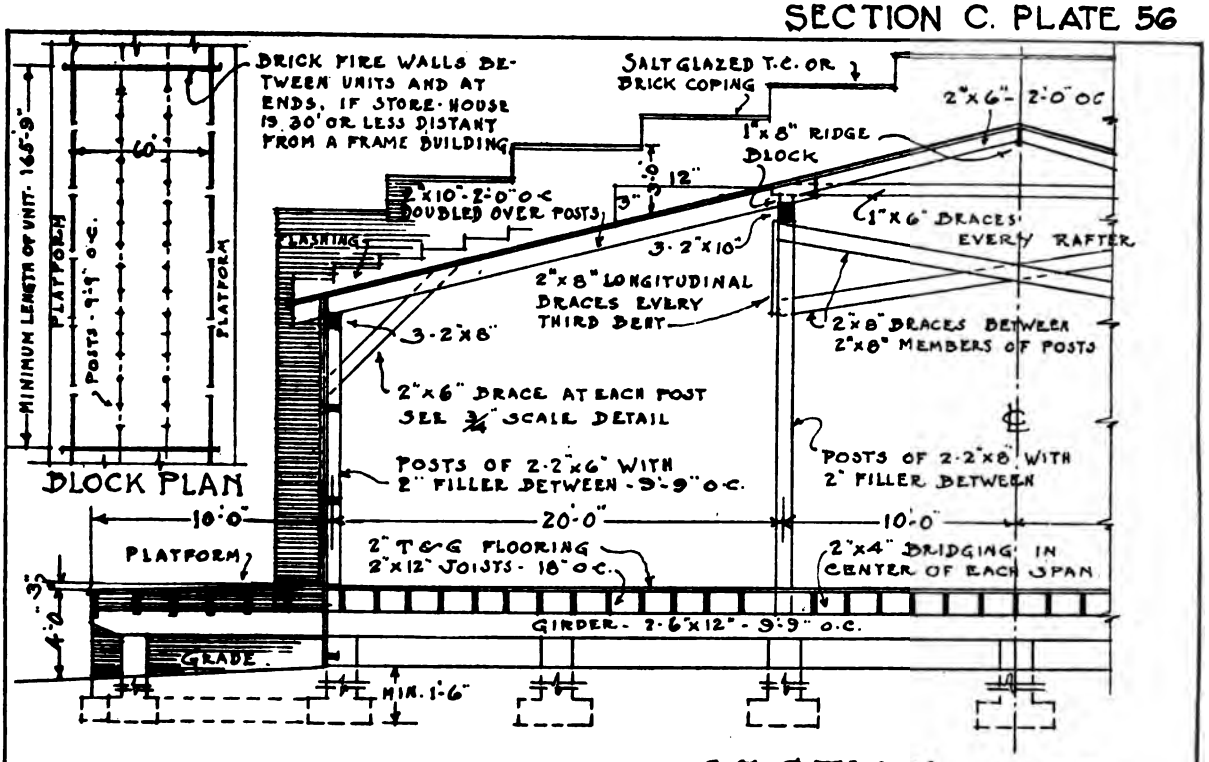
FOR DETAILS SEE DRAWINGS 620-313,314.5

CONSTRUCTION DIVISION OF THE ARMY

TYPICAL BUILDINGS

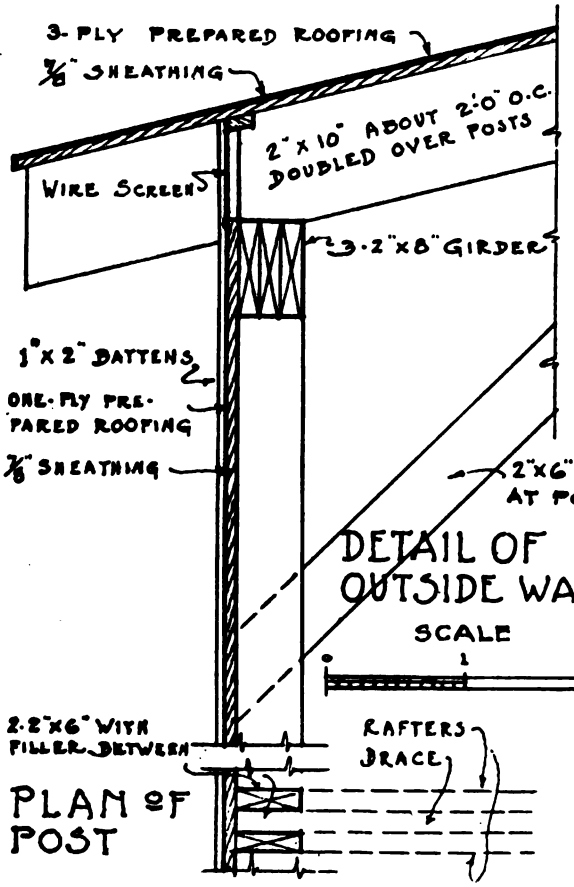
DETAILS · TWO STORY BUILDINGS

TYPICAL BUILDINGS


BRICK FIRE WALLS BETWEEN UNITS AND AT ENDS, IF STORE-HOUSE IS 30' OR LESS DISTANT FROM A FRAME BUILDING
SALT GLAZED T.C. OR BRICK COPING
2"x6"- 2'-0" OC
1"x8" RIDGE BLOCK
2"x10"-2'-0" O.C DOUBLED OVER POSTS
1"x6" BRACES EVERY RAFTER
3-2"x10"
FLASHING
2"x8" LONGITUDINAL BRACES EVERY THIRD BENT
2"x8" BRACES BETWEEN 2"x8" MEMBERS OF POSTS
3-2"x8"
2"x6" BRACE AT EACH POST SEE 3/4" SCALE DETAIL
POSTS OF 2-2"x6" WITH 2" FILLER BETWEEN - 9'-9" O.C.
POSTS OF 2-2"x8" WITH 2" FILLER BETWEEN
MINIMUM LENGTH OF UNIT - 165'-9"
PLATFORM
POSTS - 9'-9" O.C.
60'
BLOCK PLAN
10'-0"
20'-0"
10'-0"
PLATFORM
2" T&G FLOORING
2"x12" JOISTS - 18" O.C.
2"x4" BRIDGING IN CENTER OF EACH SPAN
GIRDER - 2-6"x12" - 9'-9" O.C.
GRADE
MIN. 1'-6"

SECTION

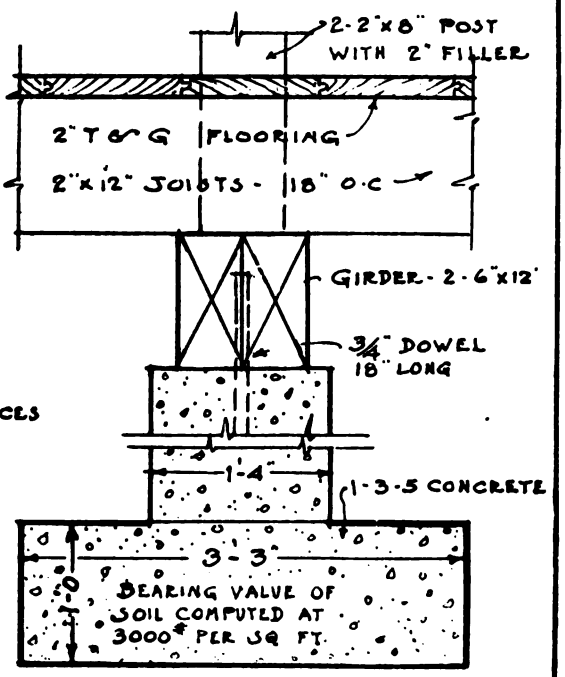
SCALE
0 1 2 3 4 5 6 7 8 9 10



DETAIL OF OUTSIDE WALL

SCALE
1 2

PLAN OF POST



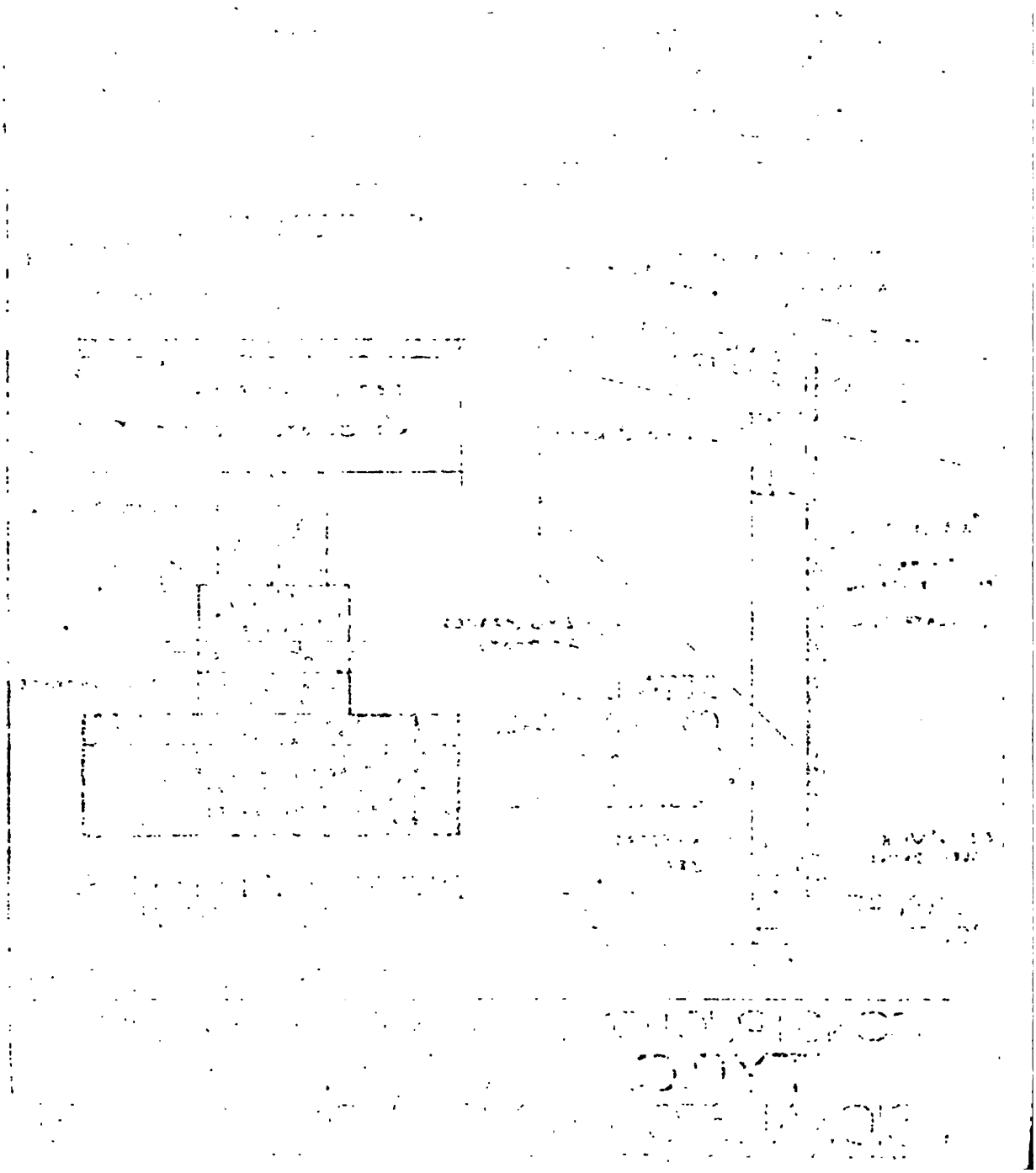
DETAIL OF INTERIOR POST AND FOOTING

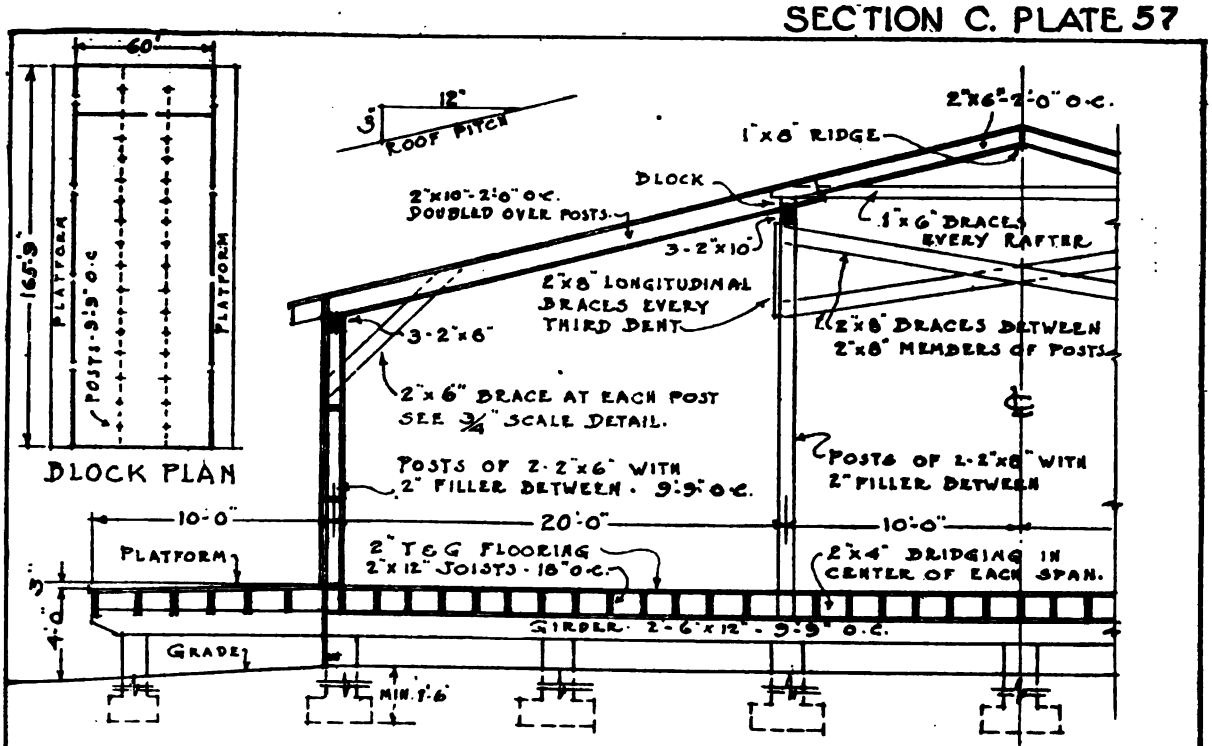
FOR ORIGINAL SEE DRAWING 620-319

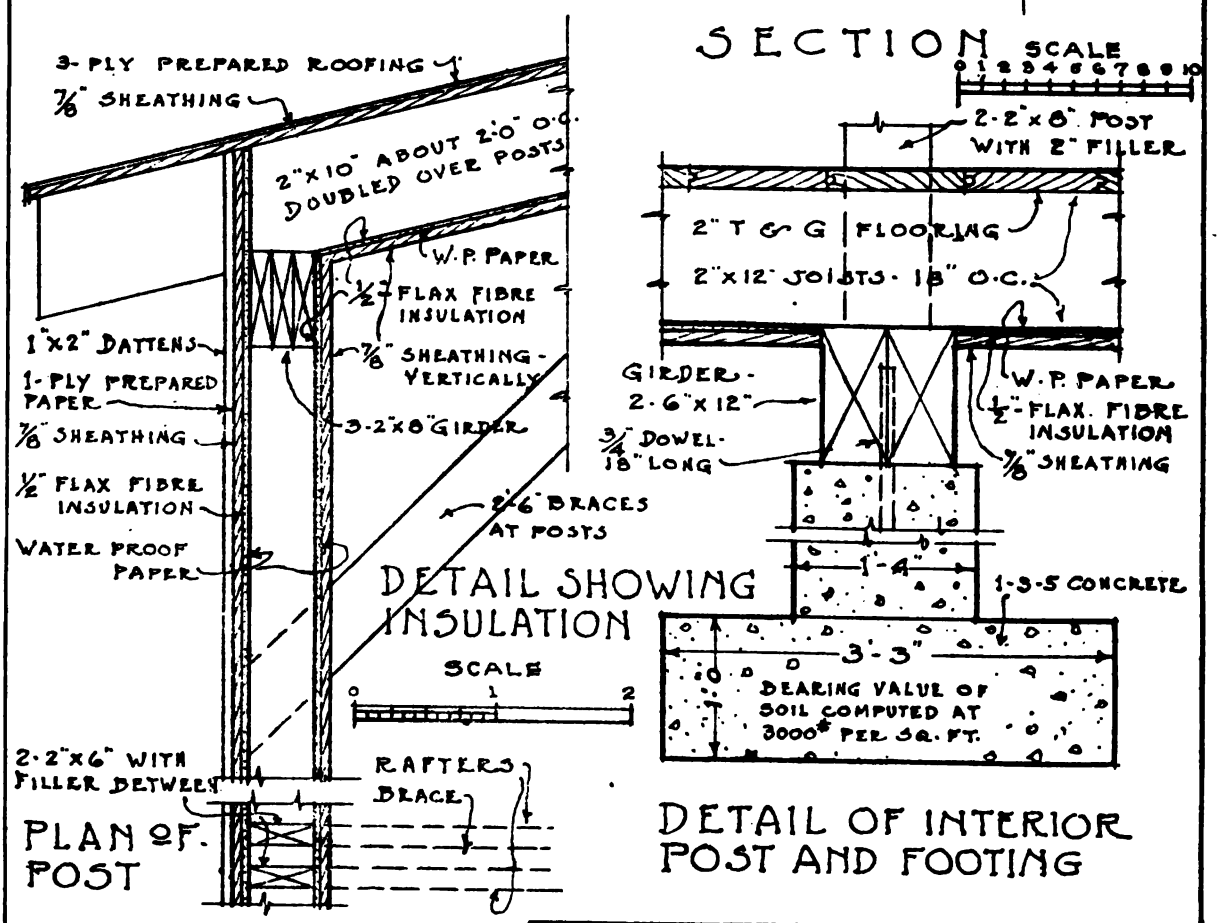
CONSTRUCTION DIVISION OF THE ARMY

TYPICAL BUILDINGS

DIVISIONAL STORE HOUSE - NON-INSULATED





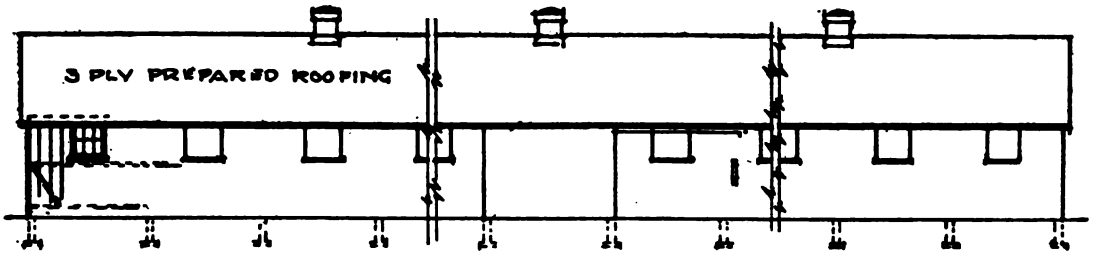


FOR ORIGINAL SEE DRAWINGS 620-482 & 483

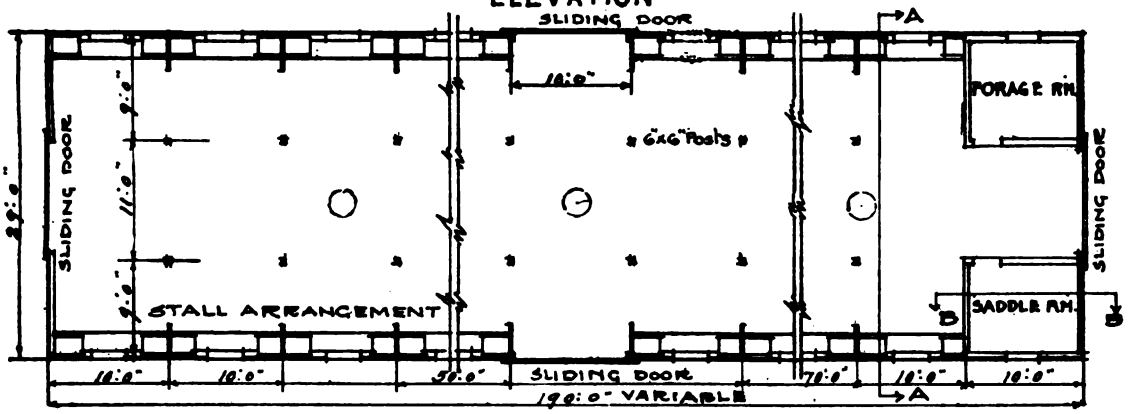
CONSTRUCTION DIVISION OF THE ARMY

TYPICAL BUILDINGS

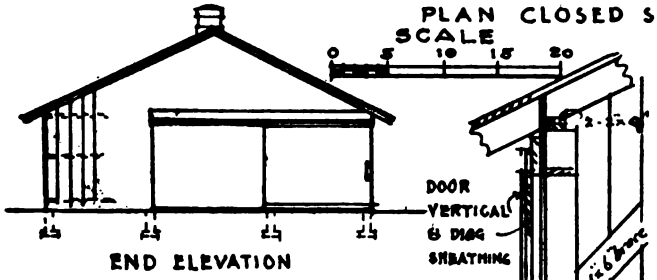
DIVISIONAL STORE HOUSE INSULATED



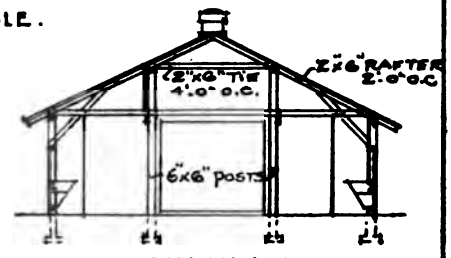
ELEVATION



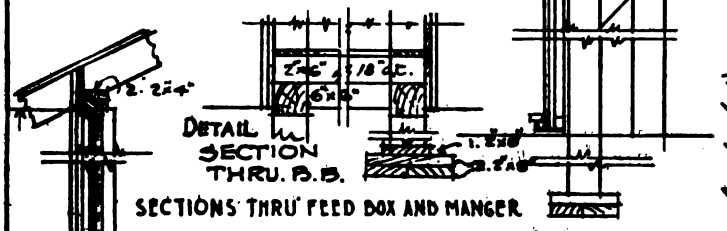
PLAN CLOSED STABLE.



END ELEVATION

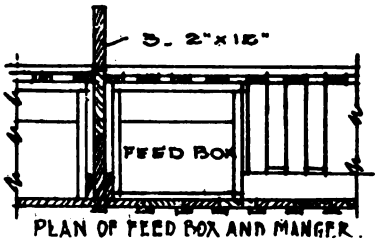


SECTION A-A



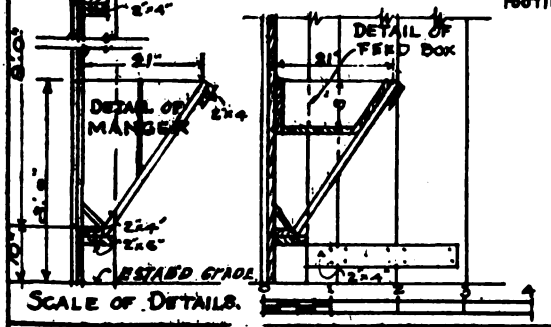
DETAIL IN SECTION THRU. B.B.

SECTIONS THRU FEED BOX AND MANGER



PLAN OF FEED BOX AND MANGER.

SLIDING DOOR & FOOTING (DETAIL)



SCALE OF DETAILS.

SCHEDULE.

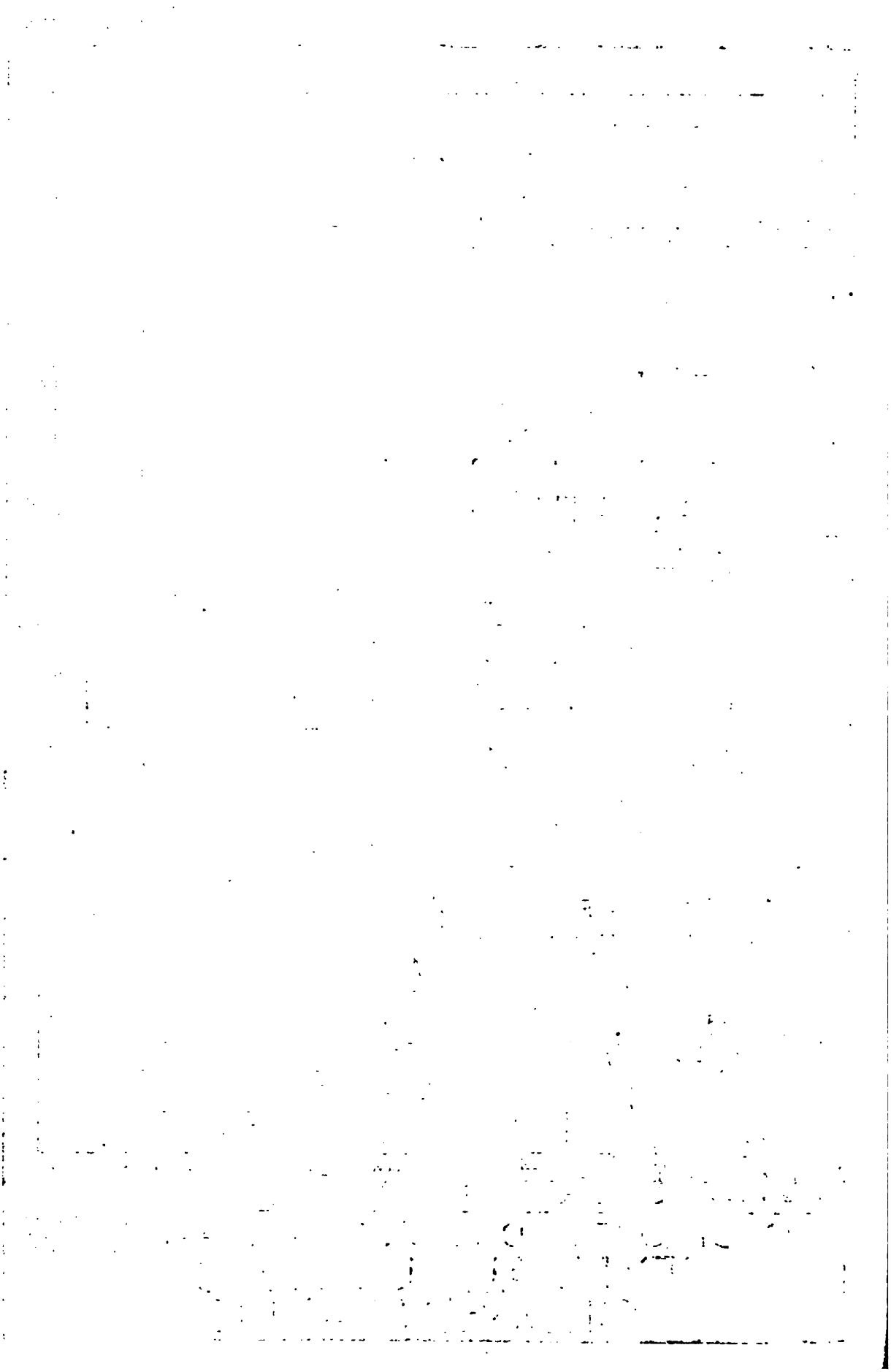
LENGTH OF BLDG.	Nº OF ANIMALS.	Nº OF CROSS PASS.
100 FT.	36	
130 "	40	
130 "	44	1
140 "	48	1
150 "	52	1
160 "	56	1
180 "	60	2
190 "	64	2
200 "	68	2

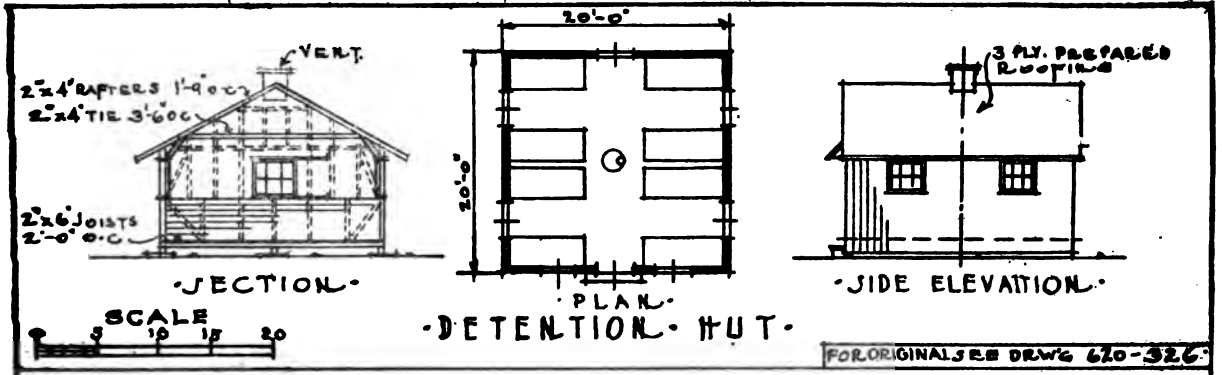
ALLOW 10 FT. LENGTHS OF BUILDING FOR EVERY 4 ANIMALS, PLUS 10 FT. FOR EACH CROSS PASSAGE AND 10 FT. FOR STORE ROOM BAY.

CONSTRUCTION DIVISION OF THE ARMY

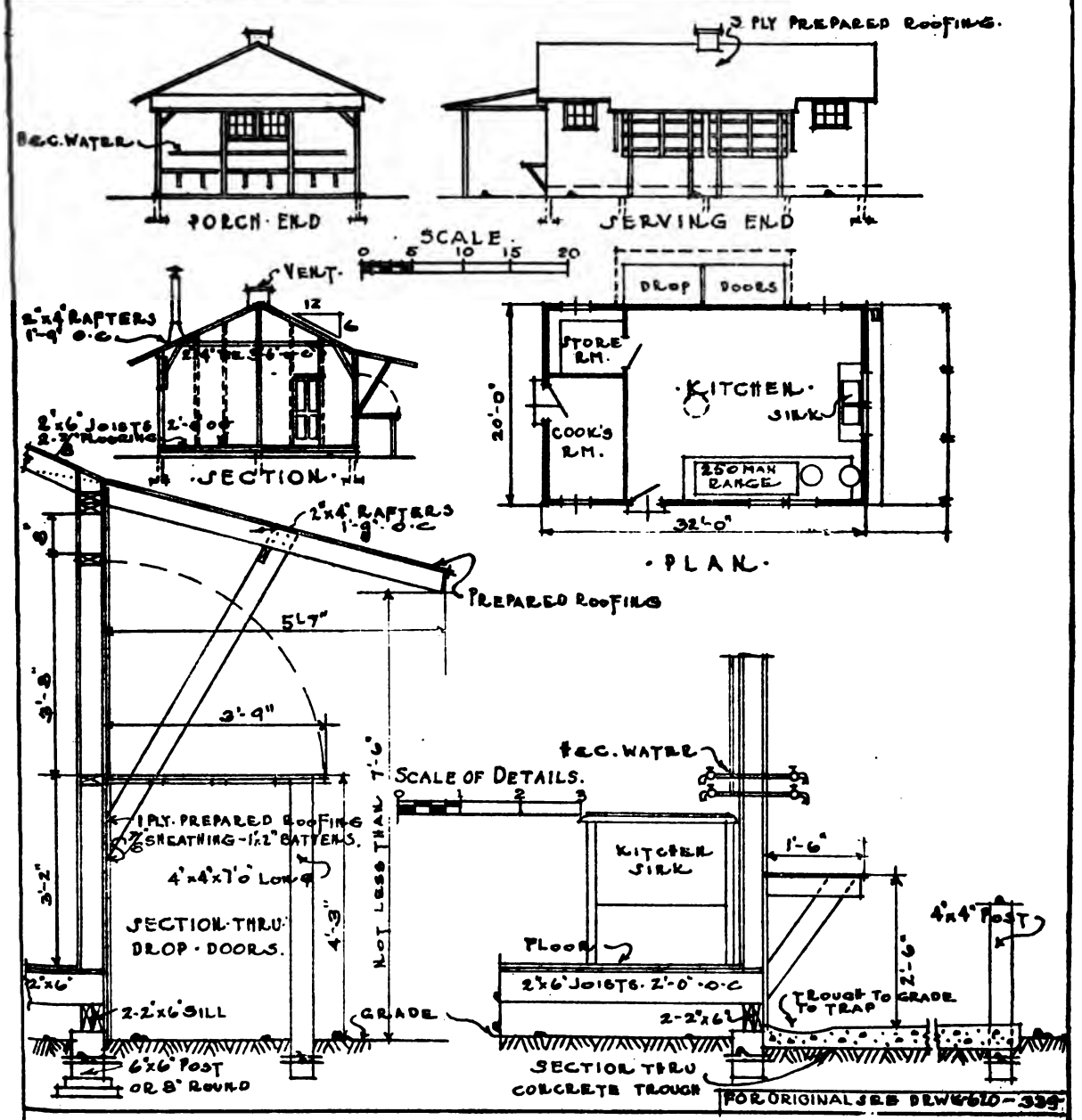
TYPICAL BUILDINGS
CLOSED STABLE

FOR ORIGINAL SEE DRAWING 620-421.





FOR ORIGINALS SEE DRW'G 620-326

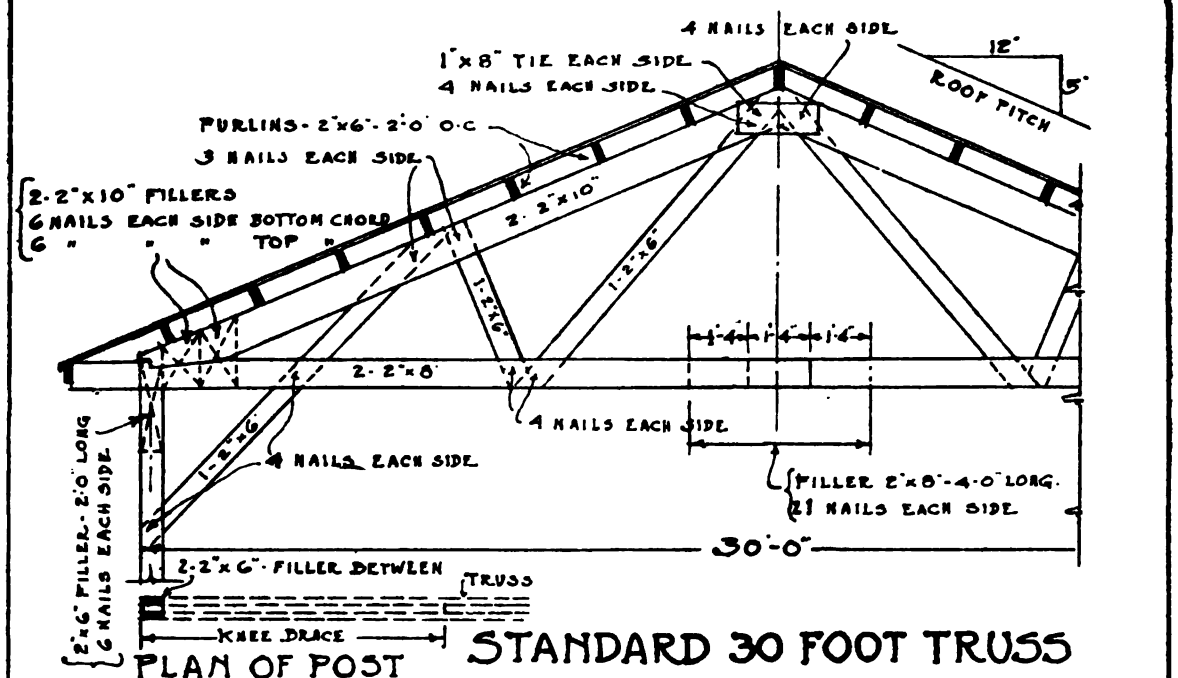


FOR ORIGINALS SEE DRW'G 620-325

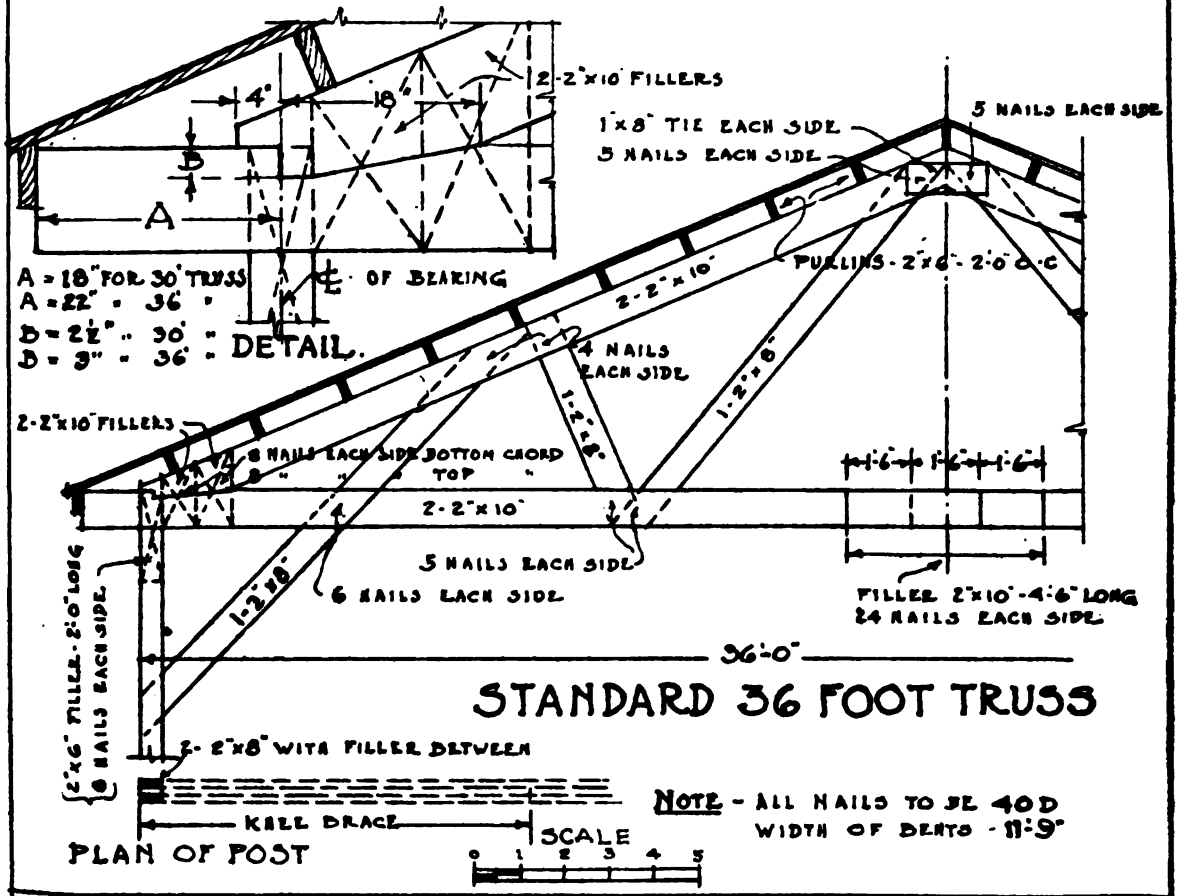
CONSTRUCTION DIVISION OF THE ARMY

TYPICAL BUILDINGS

DETENTION HUT & KITCHEN FOR DETENTION & QUARANTINE CAMPS



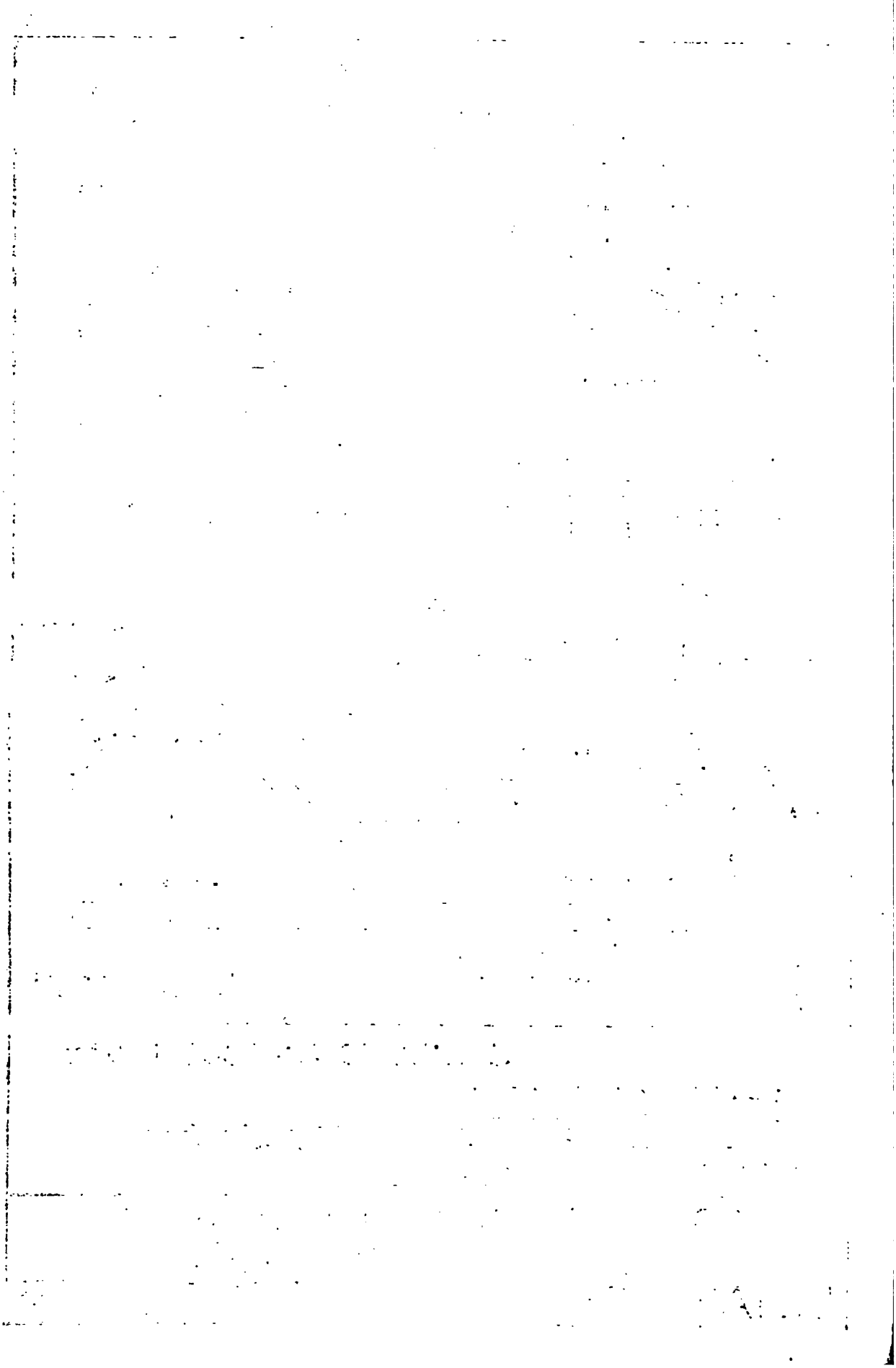
STANDARD 30 FOOT TRUSS



STANDARD 36 FOOT TRUSS

NOTE - ALL NAILS TO BE 40D
WIDTH OF BENTS - 11'-9"

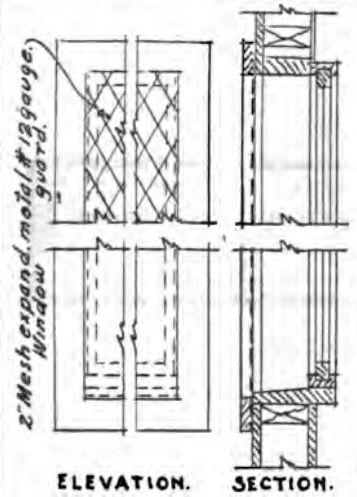
CONSTRUCTION DIVISION OF THE ARMY
TYPICAL BUILDINGS
DETAILS OF STANDARD ROOF TRUSSES



APPROXIMATE BASIS FOR CAPACITY FOR ONE AND TWO STORY BUILDINGS.						
WIDTH OF BUILDINGS.	NO.	SIZE	LENGTH OF BLD'G.	NO.	SIZE	LENGTH OF BLD'G.
20'-0" OR LESS.	1	20"	FOR EACH 45'-0"	1	16"	FOR EACH 30'-0"
MORE THAN 20'-0" & UP TO 26'-0"	1	20"	" " 35'-0"	1	16"	" " 25'-0"
" " 26'-0" " " 32'-0"	1	20"	" " 30'-0"	1	16"	" " 20'-0"
" " 32'-0" " " 40'-0"	1	20"	" " 25'-0"	1	16"	" " 18'-0"
" " 40'-0" " " 50'-0"	1	20"	" " 20'-0"			
" " 50'-0" " " 60'-0"	1	20"	" " 15'-0"			
" " 60'-0" " " 75'-0"	1	20"	" " 15'-0"			

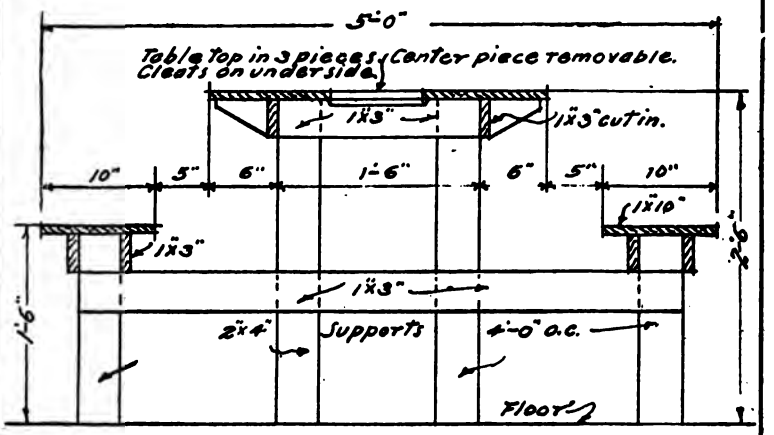
TYPICAL STEEL VENTILATOR.

FOR ORIGINAL SEE DRAWING 620-325.



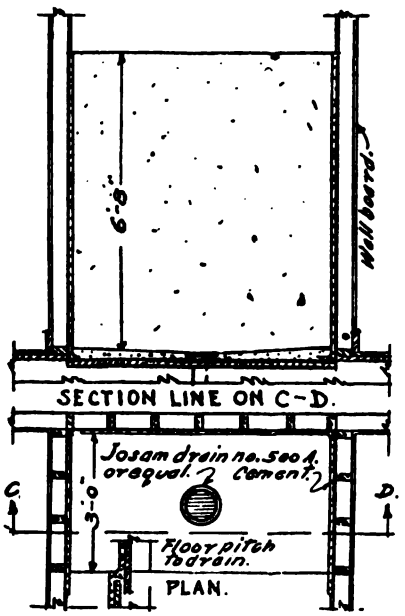
TYPICAL WINDOW GUARD.

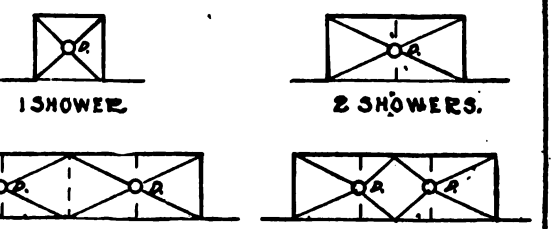
FOR ORIGINAL SEE DRAWING 620-331.



MESS TABLE AND SEATS.

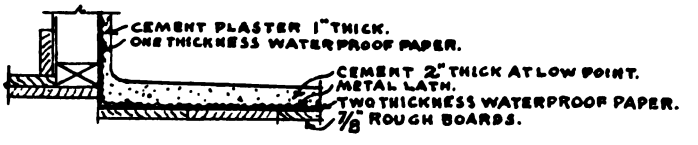
FOR ORIGINAL SEE DRAWING 620-355.





TYPICAL ARRANGEMENT FOR SHOWER DRAINS.

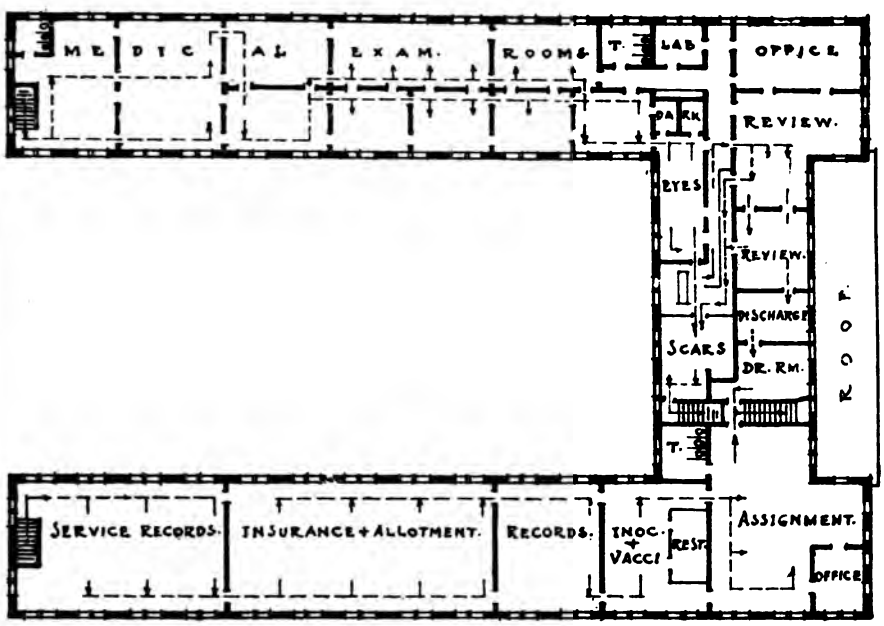
NOTES.
STUDDING 12" O.C.
CEMENT FLOOR. 1 CEMENT - 2 OF SAND. 5% HY'D LIME.
CEMENT PLASTER. 2 COATS. 1 CEMENT. 3 OF SAND.
10% HYDRATED LIME ADDED.



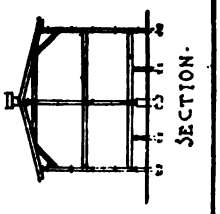
TYPICAL ROOM SHOWER STALL.

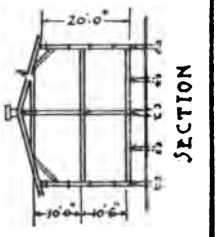
FOR ORIGINAL SEE DRAWING 620-420.

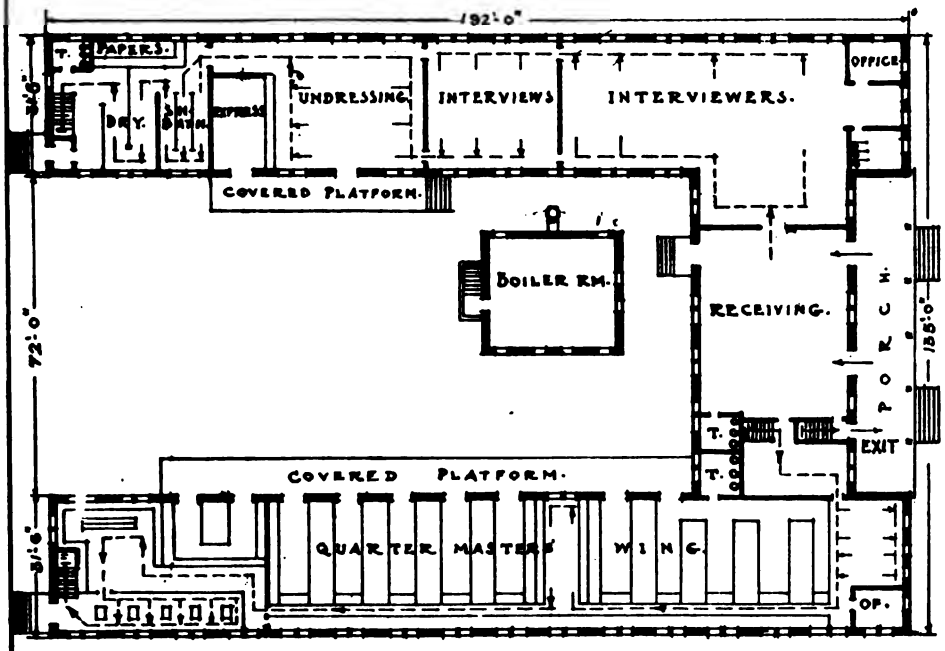
CONSTRUCTION DIVISION OF THE ARMY
TYPICAL BUILDINGS
G.S. VENTS · MESS TABLES SHOWER STALLS · WINDOW GUARDS



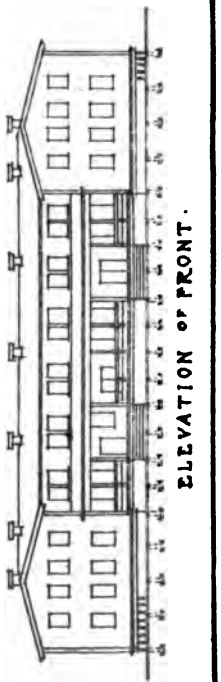
SECOND FLOOR PLAN.







FIRST FLOOR PLAN.

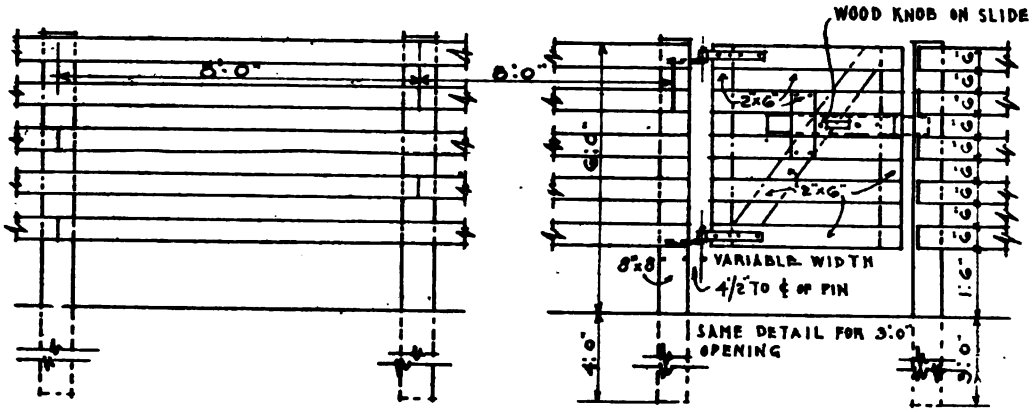


SCALE
40 20 30 40

FOR ORIGINAL SEE DRAWINGS - NO 620-488-489.

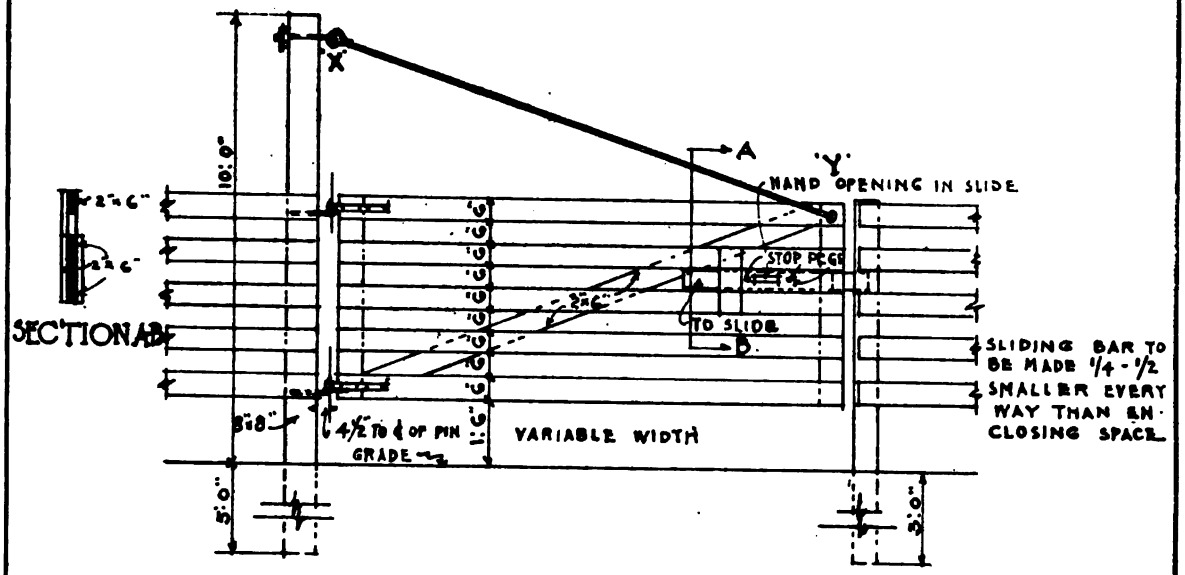
CONSTRUCTION DIVISION OF THE ARMY
TYPICAL BUILDINGS
RECRUIT EXAMINATION BUILDING

CONSTRUCTION DIVISION OF THE ARMY
CANTONMENT GROUNDS
TYPICAL LAYOUT · REMOUNT STATION FOR 7500 ANIMALS

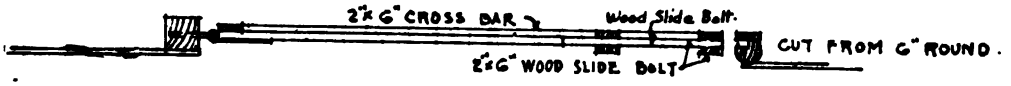


ELEVATION OF FENCE

FOOT GATE

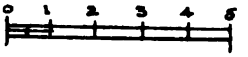


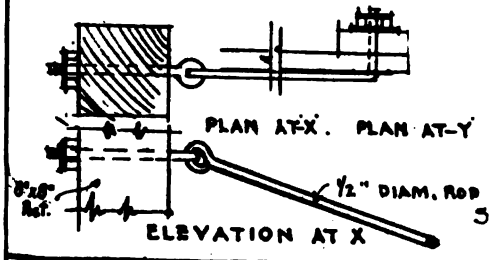
ELEVATION OF DRIVE GATE



PLAN OF GATE

SCALE





NOTES
ALL POSTS TO BE PLACED 6'-0" ON CENTRE AND NOT LESS THAN 3'-0" IN THE GROUND
ALL BOARDS 2" x 6" x 16'-0" POSTS 6" TO 8" DIAM.
SEE DRAWING 404-36 FOR FENCE AT CUTOUTS & CHUTES
GATES MUST BE HUNG TO SWING ON AN ARC OF AT LEAST 180°
THIS DRAWING SUPERSEDES REMOUNT DRAWING Nº 404-15 CANTONMENT BUILDINGS Nº 108.

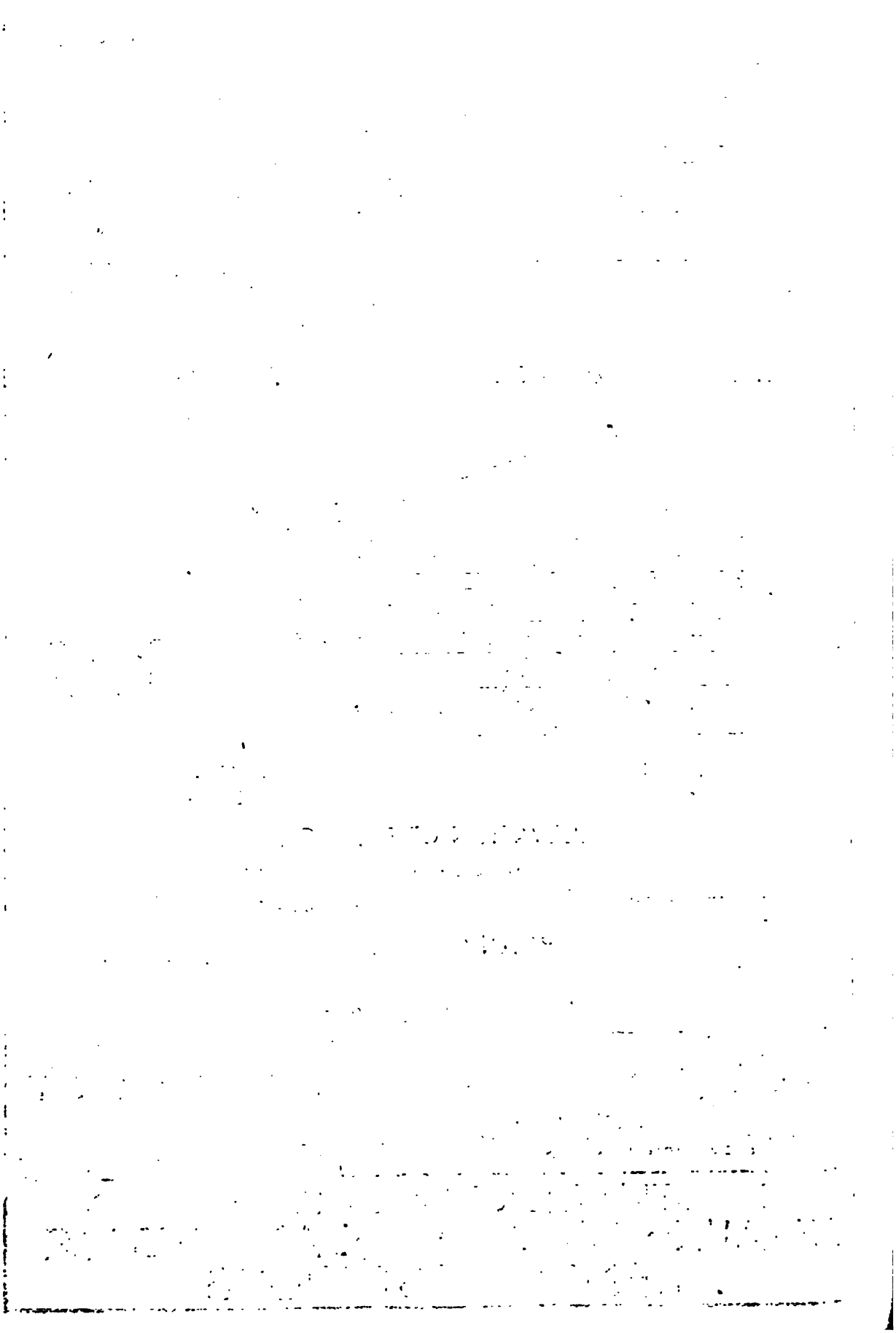
SCALE

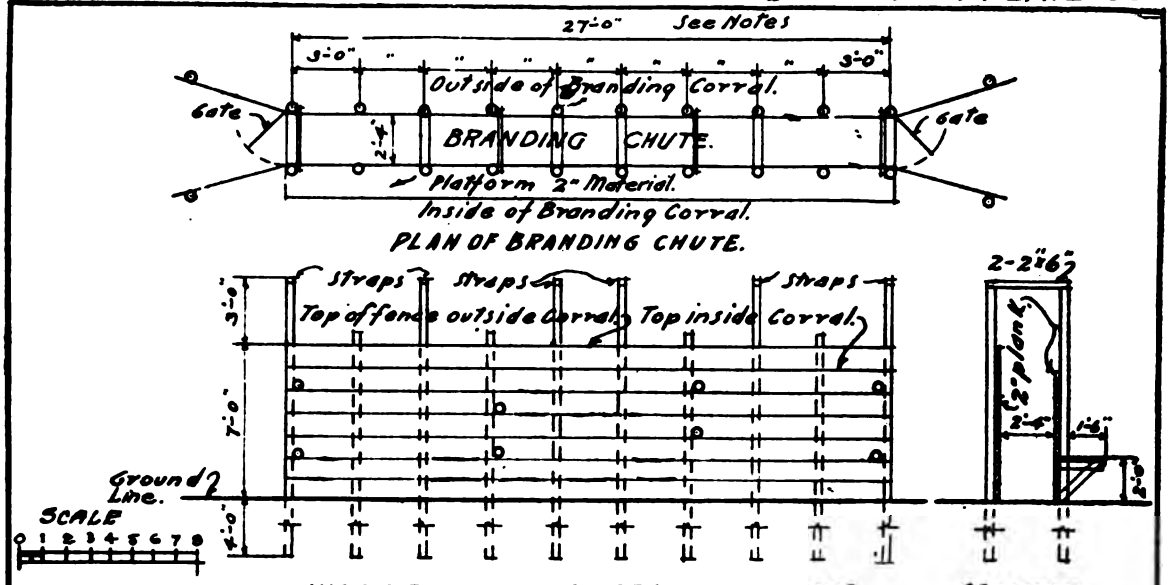
FOR ORIGINAL SEE DRAWING 404-28

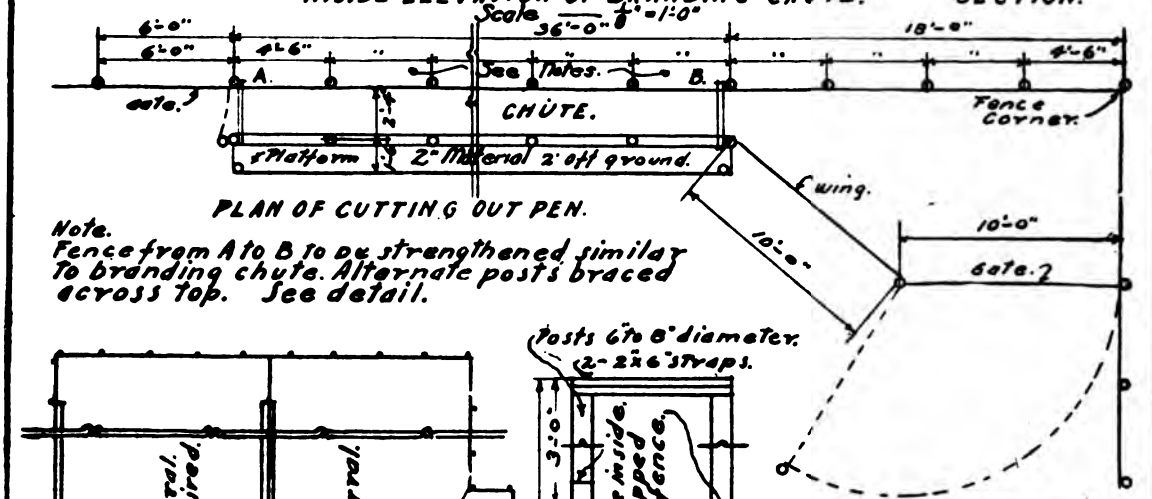
CONSTRUCTION DIVISION OF THE ARMY

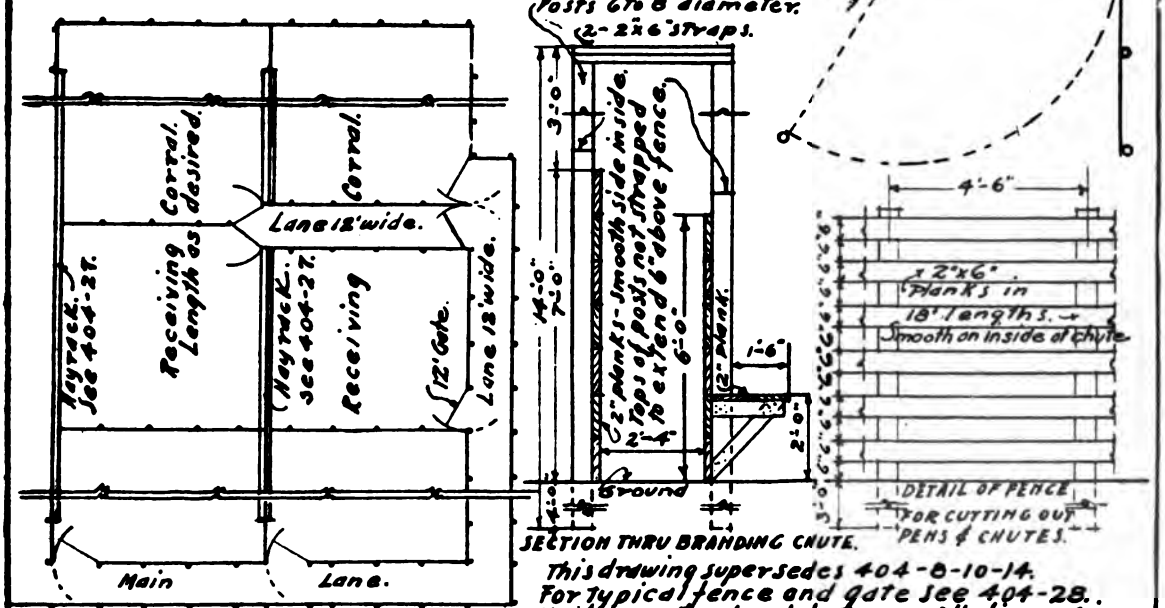
DETAILS-TYPICAL GATE AND FENCE

REMOUNT STATIONS







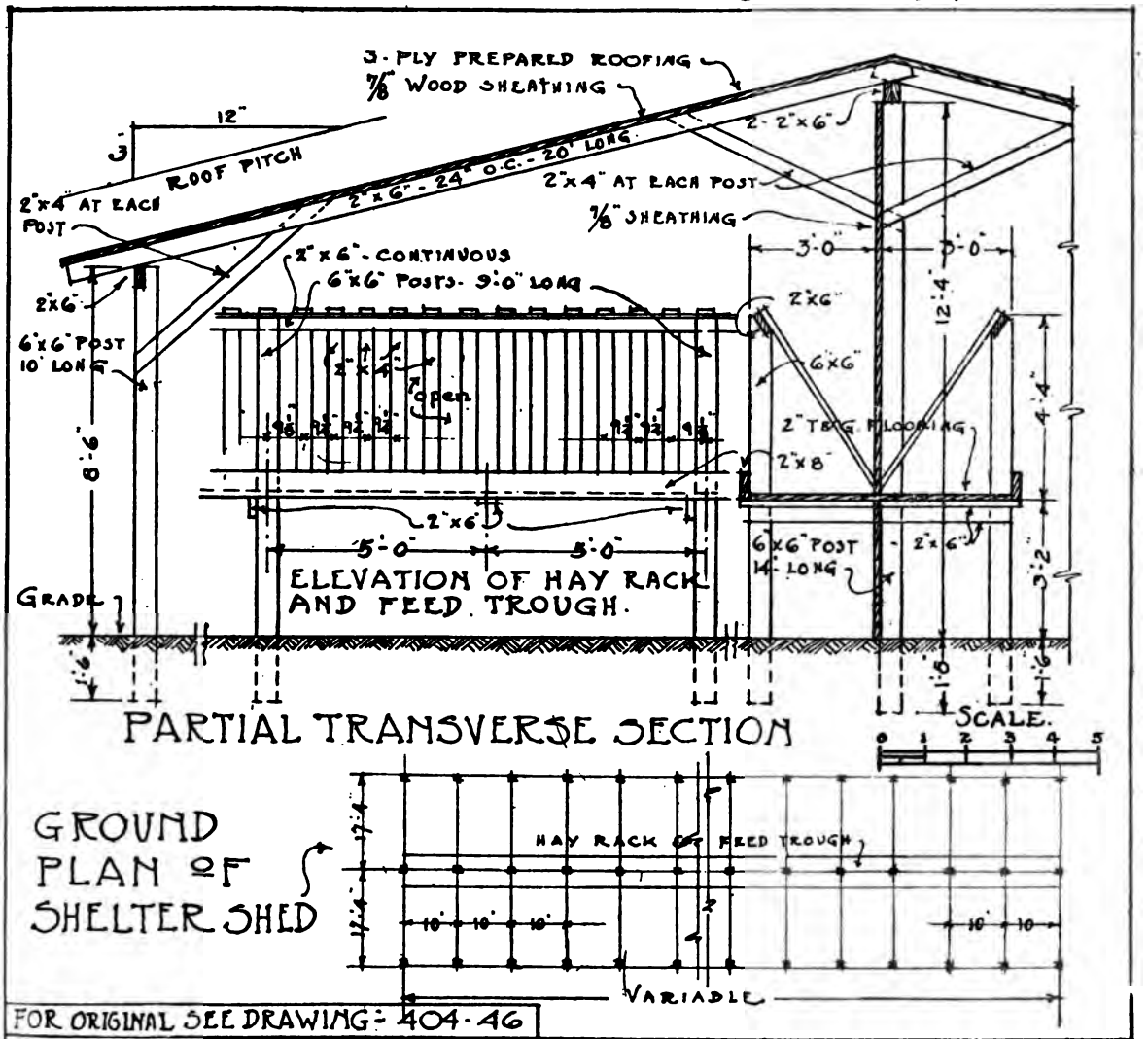


PLAN OF TYPICAL RECEIVING CORRAL.

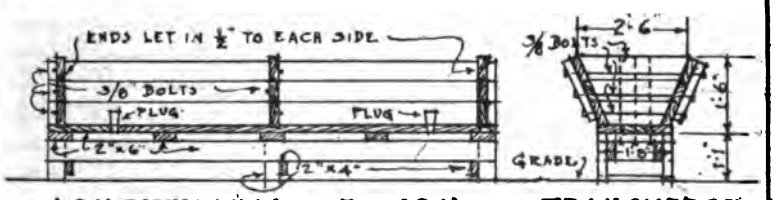
This drawing supersedes 404-B-10-14.
For typical fence and gate see 404-28.
Units are standard, but over-all dimensions may vary as directed, in multiples of any standard unit.

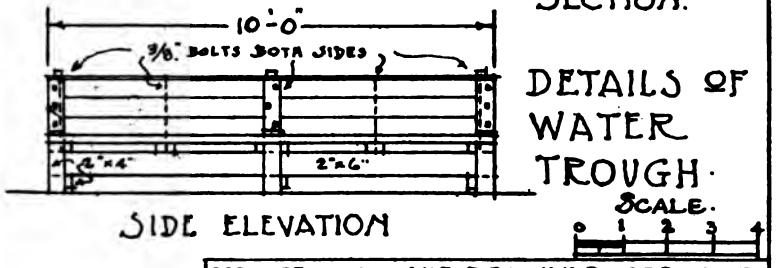
FOR ORIGINAL SEE DRAWING 404-36.

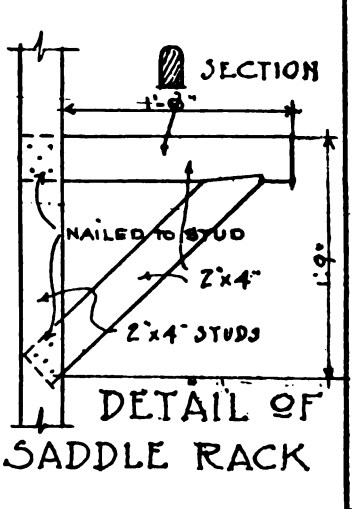
CONSTRUCTION DIVISION OF THE ARMY
REMOUNT STATIONS
CUTTING OUT PEN · BRANDING CHUTE · RECEIVING CORRAL



FOR ORIGINAL SEE DRAWING - 404-46







FOR ORIGINAL SEE DRAWING 620-423.

CONSTRUCTION DIVISION OF THE ARMY

REMOUNT STATIONS

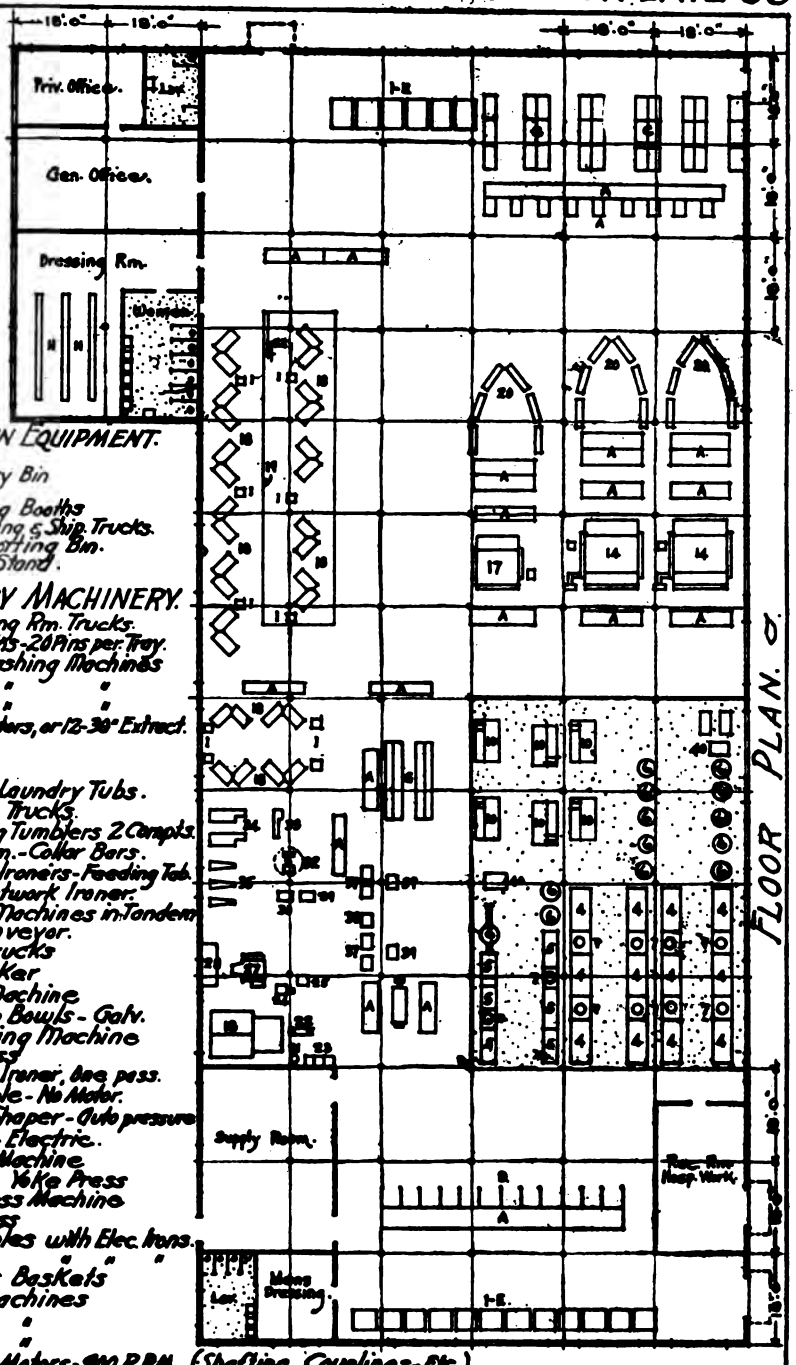
SHELTER SHED·WATER TROUGH & SADDLE RACK

MISCELLANEOUS-BUILDINGS-DESCRIPTION & REFERENCE-DRW'GS

NOTE: REFERENCE DRAWINGS HAVE SAME JOB NUMBER UNLESS OTHERWISE NOTED.

JOB	DRW'G	NAME OF BUILDING	SIZE	BENTS	HEIGHT	NOTES (UNLESS OTHERWISE NOTED ALL BLD'GS ARE OF WOOD CONST.	CONSTN. DETAILS.		ELEC.	PLUMB.	HOT WATER	STEAM HEAT	STOVE HEAT	VENTS.
608	20-20 21-22	AUDITORIUM.	200×300	23'0"		FRAME & STUCCO, PLASTERED INSIDE, STEEL TRUSSES AND WOOD ROOF.	20 21	22	29			41		620-325
6339	131	CAFETERIA.	54×189	14'6"	1 STORY.	TWO DINING ROOMS 54×59', KITCHEN AND STORE ROOMS.	133	134	131	131		131		
6370	106	"	132×173	12'0"	2 STR'S.	CAP. OFFICERS 118, MEN 417, WOMEN 712, KITCHEN AND BED ROOMS FOR 20 BEDS.	106	108	106	105	105	109		620-325
6209	113	"	105×192	16'0"	1 STORY.	4 DIN'G RMS, SEATS 244 EACH, KITCHEN & STORE RMS, CAP. 2000	112	113	112	112	112		620 329 330	620-325
6383	110	"	110×171		"	2 DIN'G RM'S SEATS 194 EACH } KITCHEN 2 " " " 102 " } & ETC.	111	112	112	110	110	112		620-325
6403	111	"	156×200		2 STR'S	MEN'S DIN'G RM. SEATS 1000 } KITCHEN WOMEN " " " 500 } & ETC.	111	113	101	101		114		620-325
632	551	DELOUSING PLANT.	48×84	12'0"	1 STORY.	24 MEN PER. ½ HOUR	551		551	591	591	591		620-325
"	550	" "	54×120	"	"	48 MEN PER. ½ HOUR	550		550	590	590	590		620-325
"	552	" "	60×204	"	"	130 MEN PER. ½ HOUR.	552		552	589	589	589		620-325
6307	110	DORMITORY FOR MEN.	28×113	15'0"	2 STR'S.	47 SINGLE BED ROOMS, SOCIAL HALL 14'×22' & ETC.	6316 105		110	110	110		6316 101	
"	121	DORMITORY & DINING ROOM.	29×136	"	"	58 SINGLE BED ROOMS } KITCHEN DINING ROOM 28×29 } & ETC.	6316 103		121	121	121		6316 101	
6339	111	" " "	29×136	"	"	60 SINGLE BED ROOMS } SERVING RM DINING ROOM 29×30 } & ETC.	6316 103		111	111	111		6316 101	
6242	5	GARAGE MECHANICAL REPAIR UNIT NO. 305.	140×144	16'0"	1 STORY.		5		5	5				620-325
6311	105	" SCITUATE PROVING GROUNDS. MASS.	61×164	18'0"	"	BRICK WALLS & WOOD TRUSSES.	106		158	105				620-325
652	17	" ORDNANCE.	50×VAR	20'0"	"	TILE WALLS, WOOD TRUSSES. HEATER ROOM.	17		17	17		17		620-325
"	214	GUARD HOUSE, TYPE NO. 1	20×56	7'0"	"		214		214	214			620 329 330	
6143	2	GAS INSTRUCTION.	16×30		"		2							
6309	121	HOUSING, 4 FAMILY HOUSE	38×53		2 STR'S.	KITCHEN, LIVING ROOM & TWO BED ROOMS. } EACH	102 103	104	105	105			6316 101	
"	180	" 1 " "	24×26		"	KITCHEN, DINING RM, LIVING RM. AND THREE BED ROOMS.	102 103	104	105	105			6316 101	
"	160	" BOARDING "	27×38		"	KITCHEN, LIVING ROOM AND EIGHT BED ROOMS.	102 103	104	105	105			6316 101	
"	150	" 1 FAMILY. "	24×30		1 STORY	KITCHEN, LIVING RM. & TWO BED RMS.	102 103	104	105	105			6316 101	
"	190	" 1 " "	24×32		"	KITCHEN, LIVING ROOM AND TWO BED ROOMS.	102 103	104	105	105			6316 101	
"	200	" 2 " "	25×36		2 STR'S.	KITCHEN, DINING, LIVING AND THREE BED ROOMS } EACH.	102 103	104	105	105			6316 101	
633	140	LAUNDRY.	36×108	18'0"	1 STORY.	1000 TO 2000 MEN.	101	102	140	142	141	141		
"	130	"	72×216	"	"	5000 TO 10000 MEN.	101	102	130	132	131	131		
"	110	"	144×252	"	"	10000 TO 20000 MEN.	101	102	110	112	111	111		
"	120	"	210×170	"	"	40000 MEN.	101	102	120	122	121	121		
608	104	LECTURE HALL.	51×77	15×0		SEATING CAP. 500.	104		620 347				620 325 330	620-325
652	7	MAGAZINE-TYPE NO. 1.	51×219	20'0"	1 STORY.	TILE WALLS & WOOD TRUSSES.	7							620-325
"	9	" " NO. 2.	51×219	"	"	" " " "	9							620-325
"	179	" " NO. 10	49×208	16'0"	"	TILE OR BRICK WALLS.	179							620-325
"	180	" FOR HIGH EXPLOSIVES. NO. 11	26×42		"	TILE WALLS, CEILED INSIDE. PLATFORM AT ONE END.	180							
"	31	" NO. 12	26×42		"	CORR. ASBESTOS OR GALV. IRON SIDING. CEILED INSIDE. PLATFORM AT ONE END.	31							
"	169	" FOR HIGH EXPLOSIVES. NO. 13.	26×42		"	TILE WALLS, CEILED INSIDE. PLATFORM AT ONE END.	169							
6196	104	" BLACK POWDER.	16×22		"	CORR. ASBESTOS SIDING. CEILED INSIDE.	104		104					
652	146	" SMOKELESS POWDER. NO. 18	32×96	16'0"	"	CORR. ASBESTOS SIDING. CEILED INSIDE. PLATFORM AT ONE SIDE.	146							
"	173	PRIMER & FUSE HOUSE. TYPE NO. 1.	32×96	"	"	TILE WALLS, CEILED INSIDE. PLATFORM AT ONE SIDE.	173							
"	174	" " " " TYPE NO. 2.	32×96	"	"	TILE WALLS, CEILED INSIDE. PLATFORM AT ONE END.	174							
"	152	PYROTECHNIC PLANT. TYPE D	20×35		"	SALTPETER STORAGE. PLATFORM AT ONE END.	152							620-325
"	157	" " TYPE 1 & 1a	30×161	13'0"	"	BRICK END WALLS, RECEIVING AND DISCHARGING ROOMS & BENCH WORK.	157							620-325
"	158	" " TYPE J & J1	30×104		"	BRICK END WALLS, RECEIVING AND DISCHARGING ROOMS & BENCH WORK.	158							620-325
"	165	SHED, DOCK TYPE NO. 2	60×221	20'0"	"	TILE WALLS, STEEL TRUSSES. PLATFORMS AT END AND SIDE.	165		165					620-325
"	19	SHOP, ORDNANCE REPAIR.	30×80		"	OPTICAL, VEHICLE REPAIR, SADDLER, CARPENTER, ARMORER & MACH GUN RMS.	19		19					620-325
"	158	STORAGE BATTERY STATION. TYPE NO. 1.	39×156	20'0"	"	TILE WALLS, WOOD TRUSSES. METAL WINDOWS. PLATFORMS.	158		158					620-325
"	43	STORAGE BUILDING VEHICLES. TYPE NO. 1.	113×513	16'0"	"	TILE WALLS, BRICK FIRE WALLS, METAL WINDOWS. PLATFORM.	43							620-325
"	188	STORAGE BUILDING VEHICLES. TYPE NO. 3.	161×VAR	"	"	TILE WALLS, BRICK FIRE WALLS METAL WINDOWS. PLATFORMS	188		188					620-325
"	41	STOREHOUSE GENERAL. TYPE NO. 1.	161×501	20'0"	"	TILE WALLS, BRICK FIRE WALLS, METAL WINDOWS. PLAT. BOTH SIDES.	41							620-325
"	74	" TYPE NO. 2.	161×VAR	20'0"	"	TILE WALLS, BRICK FIRE WALLS, METAL WINDOWS. PLAT. BOTH SIDES.	71		71					620-325
6271	7	STORAGE DEPOT, ADM. BLDG.	140×160	"	2 STR'S.	BRICK WALLS, SHED ATTACHED. PLATFORMS. SEE PLAT PLAN 6271-5	7	5	10					
"	12	" OPEN SHED.	159' 1260'	"	1 STORY.	CINDER PLATFORM.	12	5	12					
"	17	" WAREHOUSES. NO. 2-3-4-5-6-7-8	161×VAR	"		BRICK WALLS, CHARGING STATION, PLATFORM, TOILETS & ETC.	17	5	12					
608	24	THEATRE, CLASS-A.	120×187	"		SEATING CAP. OVER 3000.	25 25	26 27	30				6316 101	31
"	31-32-33 346 106	" LIBERTY CLASS-D.	75×167	15'6"		SEATING CAP. 2100 WITH BALCONY.	31 32	35 106	31 32	31				31
652	81	TRANSFORMER STA TYPE NO. 1.	20×36		1 STORY.	BRICK WALLS, CONCRETE ROOF AND METAL WINDOWS.	81		81					620-325
6399	120	WELFARE BLD'G.	84×96	10'0"	"	AUDITORIUM, SEATING CAP. 200. BILLIARD & READING ROOMS.	120		103	103			6316 101	

PORTION OF WEST ELEVATION.



BUILT IN EQUIPMENT.
A Tables
B Delivery Bin
C Bin
D Marking Booths
E Receiving & Ship. Trucks.
(F) Assorting Trucks (G) Assorting Bin.
(H) Hats, Clothes Rack. (I) Stand.

SCHEDULE of LAUNDRY MACHINERY.

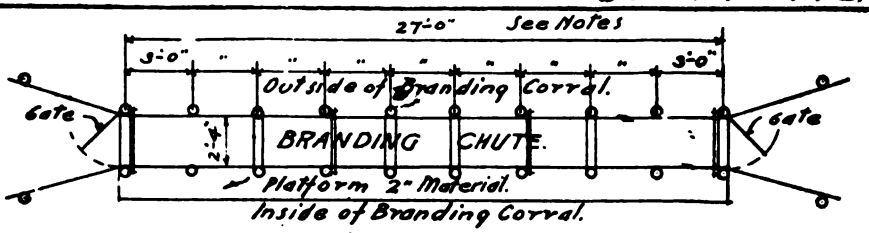
1	18	Receiving & Shipping Rm. Trucks.
3	4000	Marking Trays with Pins-20 Pins per Tray.
4	12	40x72" Iron Frame Washing Machines
5	4	36x48" " " " "
	2	30x30 " " " "
6	12	28" Solid Curb Extractors, or 12-30" Extract.
	1	20" " " "
7	10	90 Gal. Soap Tanks
8	1	Set (3) Stationary Laundry Tubs.
9	20	Metal Wash Room Trucks.
10	6	40x90 Steam Drying Tumblers 2 Compts.
12	1	2 Door Truck Dry Rm.-Collar Bars.
14	3	120" 6 Roll Flatwork Ironers-Feeding Tab.
17	1	66" Single Roll Flatwork Ironer.
18	30	38" Press Ironing Machines in Tandem
19	1	160' Garment Conveyer.
20	18	Sorting bins on Trucks
21	1	26 Gal. Starch Cooker
22	1	14" Collar Starch Machine
23	1	Set (3) Starch Dip Bowls - Galv.
24	1	12" Collar Dampening Machine
25	1	Dampening Press
27	1	24" Steam Collar Ironer, one pass.
28	1	30x96" Shaping Table - No Motor.
	1	Turn Down Collar Shaper - Auto pressure
	1	Sleeve Type Ester - Electric.
29	1	Double Cuff Press Machine
30	1	Combined Bond & Yoke Press
32	1	Steam Bosom Press Machine
33	1	Steam Body Press
34	2	Shirt Finishing Tables with Elec. Irons.
35	3	Ironing Boards " "
36	36	12 Bushel Canvas Baskets
37	4	Repair Sewing Machines
38	1	Button " "
39	2	Sock Darning "
40	2	40 H.P. Line Shaft Motors - 900 R.P.M., (Shafting, Couplings - Etc.)

Boiler H.P. for Laundry Machines only 140 H.P. not including Steam for Heating Water @ 90# P.
Total Elect. H.P. for Motors & Heating elements but not includ. Lights or other Apparatus - 96 H.P.
Cold Water for Laundry Machines only 4200 Gal. per Hour. not includ. Boiler & other requirements.
Hot Water for Laundry Machines only 3600 Gals. per hour.

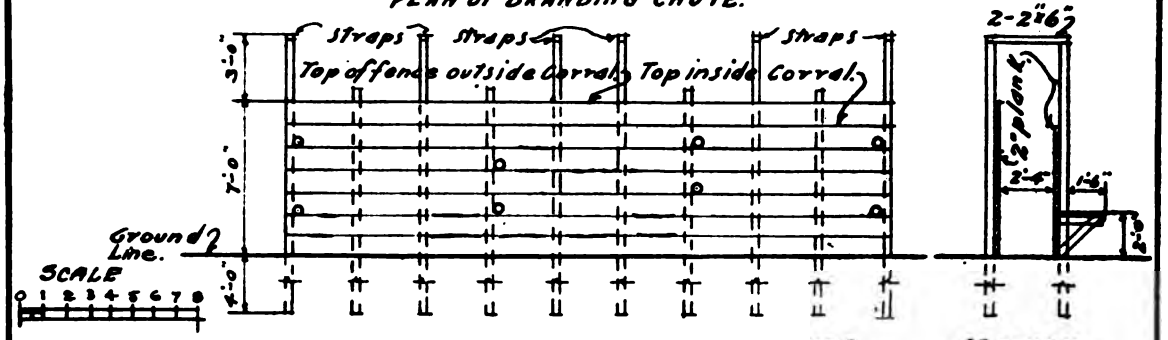
Scale 0 8 16 24 32 40

For Original See Drawing 639-110.

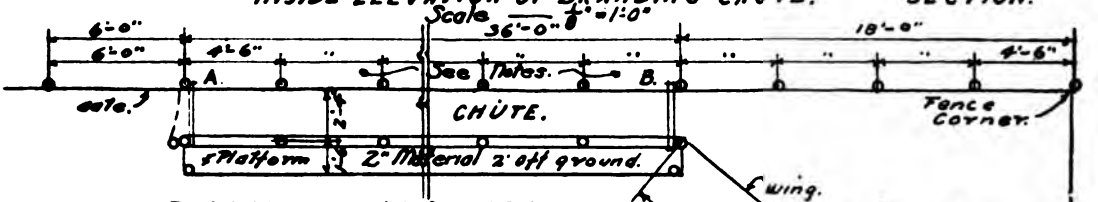
CONSTRUCTION DIVISION OF THE ARMY
STANDARD LAUNDRY
CAPACITY 10,000 TO 20,000 MEN



PLAN OF BRANDING CHUTE.

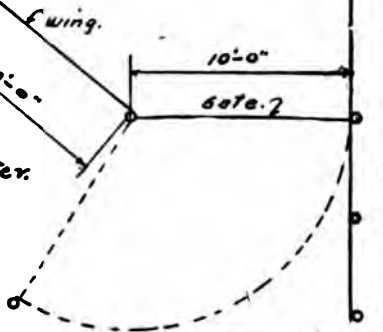


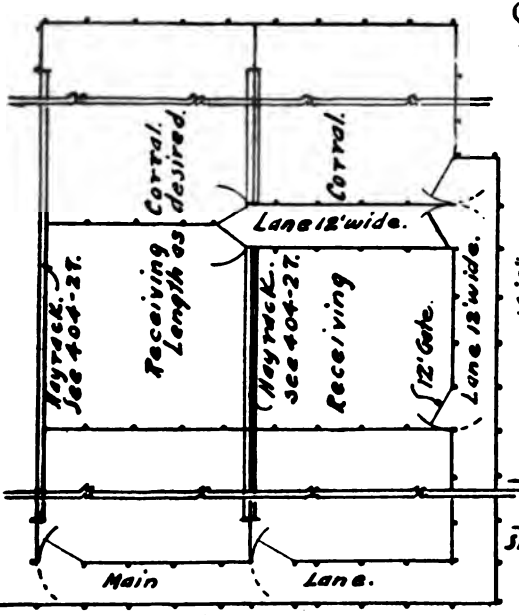
INSIDE ELEVATION OF BRANDING CHUTE. SECTION.



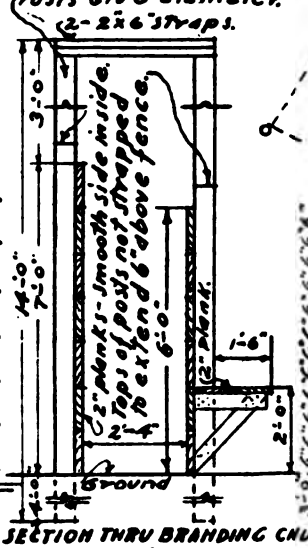
PLAN OF CUTTING OUT PEN.

Note.
Fence from A to B to be strengthened similar to branding chute. Alternate posts braced across top. See detail.

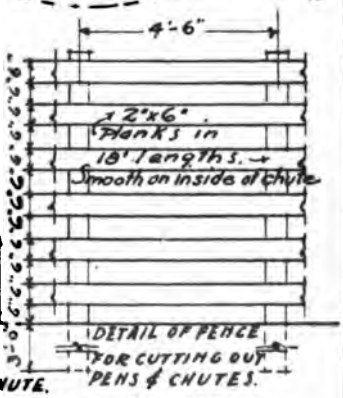




PLAN OF TYPICAL RECEIVING CORRAL.



SECTION THRU BRANDING CHUTE.



DETAIL OF FENCE FOR CUTTING OUT PENS & CHUTES.

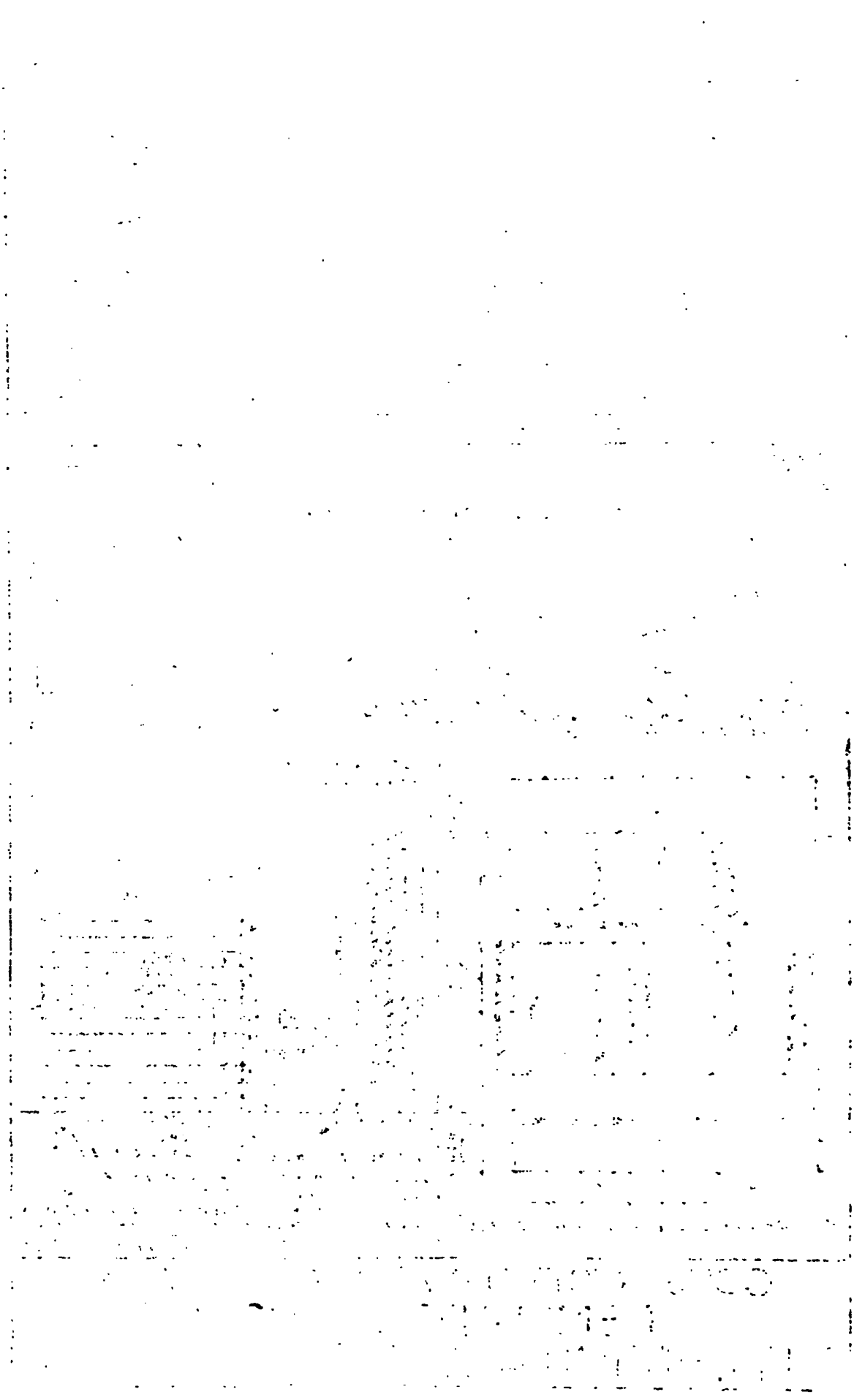
This drawing supersedes 404-8-10-14.
For typical fence and gate see 404-28.
Units are standard, but over-all dimensions may vary as directed, in multiples of any standard unit.

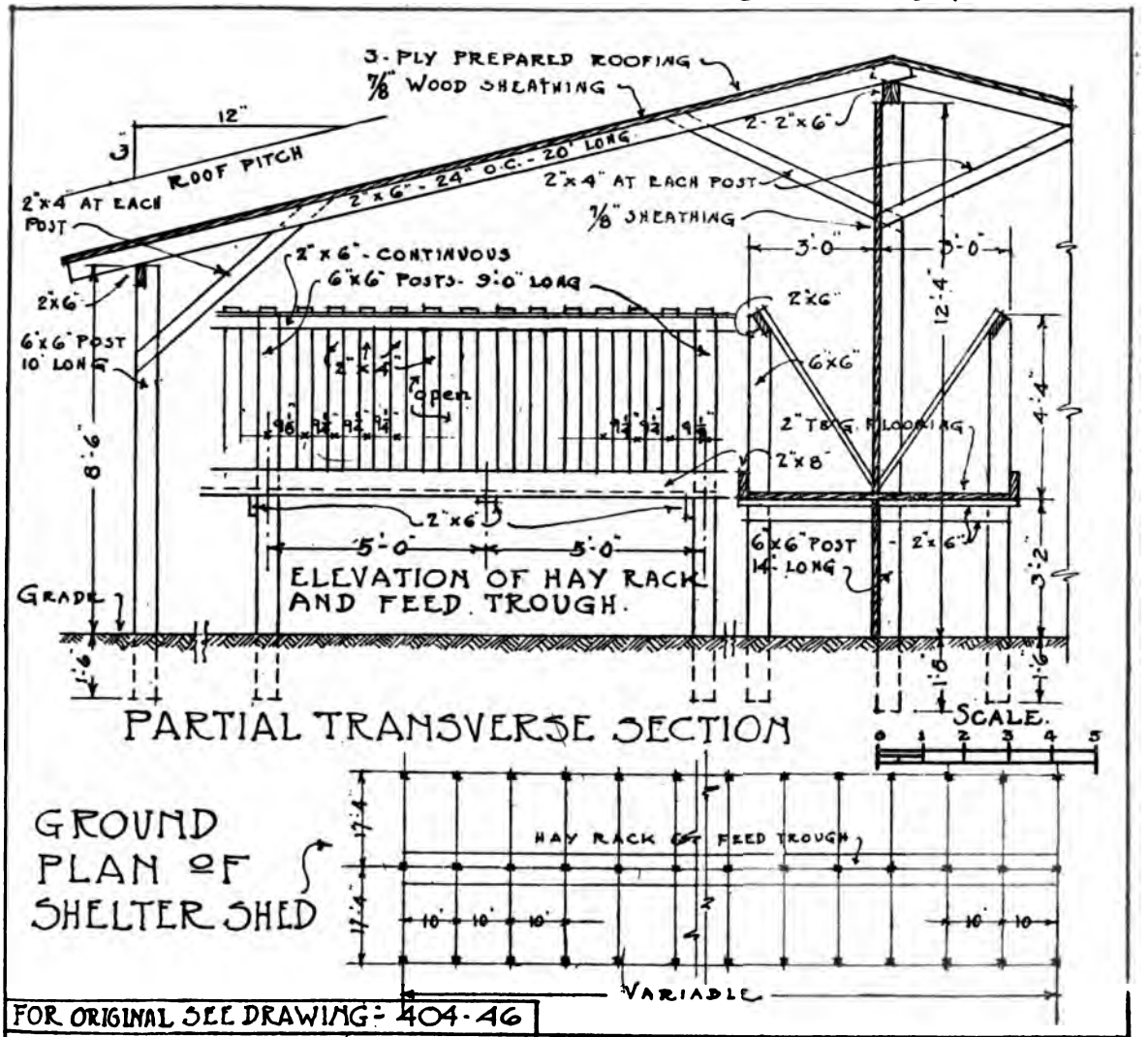
FOR ORIGINAL SEE DRAWING 404-36.

CONSTRUCTION DIVISION OF THE ARMY

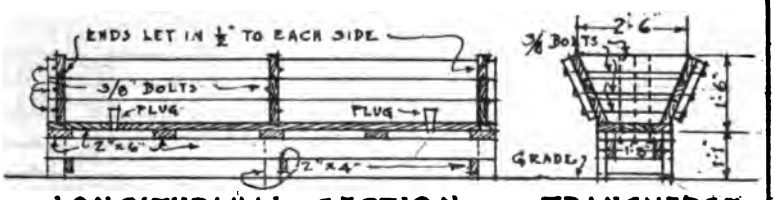
REMOUNT STATIONS

CUTTING OUT PEN · BRANDING CHUTE · RECEIVING CORRAL

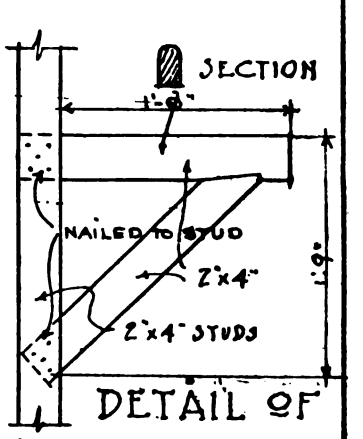




FOR ORIGINAL SEE DRAWING - 404-A6



FOR ORIGINAL SEE DRAWING 620-423.



CONSTRUCTION DIVISION OF THE ARMY

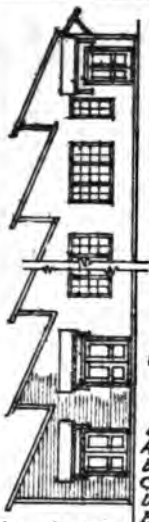
REMOUNT STATIONS

SHELTER SHED-WATER TROUGH & SADDLE RACK

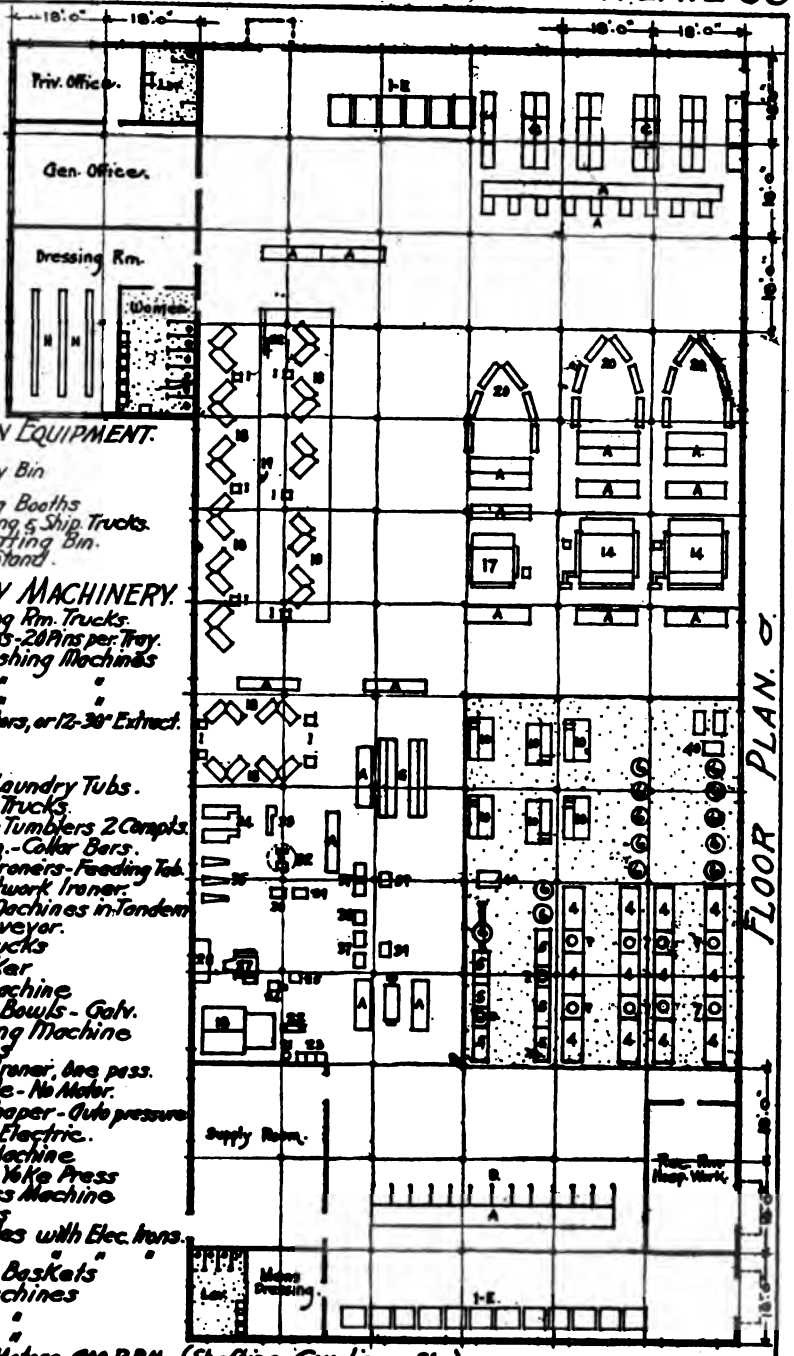
MISCELLANEOUS-BUILDINGS-DESCRIPTION & REFERENCE-DRW'GS

NOTE: REFERENCE DRAWINGS HAVE SAME JOB NUMBER UNLESS OTHERWISE NOTED.

JOB	DRW'G	NAME OF BUILDING	SIZE	BENTS	HEIGHT	NOTES {UNLESS OTHERWISE NOTED ALL BLD'GS ARE OF WOOD CONST.	CONST'N. DETAILS		ELEC.	PLUMB.	HOT WATER	STEAM HEAT.	STOVE HEAT	VENTS.
608	19-20 21-22	AUDITORIUM.	200×300	23'0"		FRAME & STUCCO, PLASTERED INSIDE, STEEL TRUSSES AND WOOD ROOF.	20 21	22	29			41		620-325
6339	131	CAFETERIA.	54×189	14'6"	1 STORY.	TWO DINING ROOMS 54×59', KITCHEN AND STORE ROOMS.	133	134	131	131		131		
6370	106	"	132×173	12'0"	2 STR'S.	CAP. OFFICERS 118, MEN 417, WOMEN 712, KITCHEN AND BED ROOMS FOR 20 BEDS.	106	108	106	105	105	109		620-325
6209	113	"	105×192	16'0"	1 STORY.	4 DIN'G RMS, SEATS 244 EACH, KITCHEN & STORE RMS, CAP. 2000	112	113	112	112	112		620-329 330	620-325
6383	110	"	110×171		"	2 DIN'G RM'S SEATS 194 EACH } KITCHEN 2 " " " 102 " } & ETC.	111	112	112	110	110	112		620-325
6403	111	"	156×200		2 STR'S	MENS DIN'G RM. SEATS 1000 } KITCHEN WOMEN " " " 500 } & ETC.	111	113	101	101		114		620-325
632	551	DELOUSING PLANT.	48×84	12'0"	1 STORY.	24 MEN PER. ½ HOUR.	551		551	591	591	591		620-325
"	550	" "	54×120	"	"	48 MEN PER. ½ HOUR	550		550	590	590	590		620-325
"	552	" "	60×204	"	"	130 MEN PER. ½ HOUR.	552		552	589	589	589		620-325
6307	110	DORMITORY FOR MEN.	28×113	15'0"	2 STR'S.	47 SINGLE BED ROOMS, SOCIAL HALL 14'×22' & ETC.	6316 103		110	110	110		6316 101	
"	121	DORMITORY & DINING ROOM.	29×136	"	"	58 SINGLE BED ROOMS } KITCHEN DINING ROOM 28'×29' } & ETC.	6316 103		121	121	121		6316 101	
6339	111	" " "	29×136	"	"	60 SINGLE BED ROOMS } SERVING RM DINING ROOM 29'×30' } & ETC.	6316 103		111	111	111		6316 101	
6242	5	GARAGE MECHANICAL REPAIR UNIT NO. 305.	140×144	16'0"	1 STORY.		5		5	5				620-325
6311	105	" SCITUATE PROVING GROUNDS. MASS.	61×164	18'0"	"	BRICK WALLS & WOOD TRUSSES.	106		158	105				620-325
652	17	" ORDNANCE.	50×VAR	20'0"	"	TILE WALLS, WOOD TRUSSES. HEATER ROOM.	17		17	17		17		620-325
"	214	GUARD HOUSE, TYPE NO. 1	20×56	7'0"	"		214		214	214			620-325 350	
6143	2	GAS INSTRUCTION.	16×30		"		2							
6309	121	HOUSING, 4 FAMILY HOUSE	38×53		2 STR'S.	KITCHEN, LIVING ROOM & TWO BED ROOMS. } EACH	102 103	104	105	105			6316 101	
"	180	" 1 " "	24×26		"	KITCHEN, DINING RM, LIVING RM. AND THREE BED ROOMS.	102 103	104	105	105			6316 101	
"	160	" BOARDING "	27×38		"	KITCHEN, LIVING ROOM AND EIGHT BED ROOMS.	102 103	104	105	105			6316 101	
"	150	" 1 FAMILY. "	24×30		1 STORY	KITCHEN, LIVING RM. & TWO BED RMS.	102 103	104	105	105			6316 101	
"	190	" 1 " "	24×32		"	KITCHEN, LIVING ROOM AND TWO BED ROOMS.	102 103	104	105	105			6316 101	
"	200	" 2 " "	25×36		2 STR'S.	KITCHEN, DINING, LIVING AND THREE BED ROOMS } EACH.	102 103	104	105	105			6316 101	
633	140	LAUNDRY.	36×108	18'0"	1 STORY.	1000 TO 2000 MEN.	101	102	140	142	141	141		
"	130	"	72×216	"	"	5000 TO 10000 MEN.	101	102	130	132	131	131		
"	110	"	144×252	"	"	10000 TO 20000 MEN.	101	102	110	112	111	111		
"	120	"	210×170	"	"	40000 MEN.	101	102	120	122	121	121		
608	104	LECTURE HALL.	51×77	15×0		SEATING CAP. 500.	104		670 347				620 325 330	620-325
652	7	MAGAZINE-TYPE NO. 1.	51×219	20'0"	1 STORY	TILE WALLS & WOOD TRUSSES.	7							620-325
"	9	" " NO. 2.	51×219	"	"	" " " "	9							620-325
"	179	" " NO. 10	49×208	16'0"	"	TILE OR BRICK WALLS.	179							620-325
"	180	" FOR HIGH EXPLOSIVES. NO. 11	26×42		"	TILE WALLS, CEILED INSIDE. PLATFORM AT ONE END.	180							
"	31	" NO. 12	26×42		"	CORR. ASBESTOS OR GALV. IRON SIDING. CEILED INSIDE. PLATFORM AT ONE END.	31							
"	169	" FOR HIGH EXPLOSIVES. NO. 13.	26×42		"	TILE WALLS, CEILED INSIDE. PLATFORM AT ONE END.	169							
6196	104	" BLACK POWDER.	16×22		"	CORR. ASBESTOS SIDING. CEILED INSIDE.	104		104					
652	146	" SMOKELESS POWDER. NO. 18	32×96	16'0"	"	CORR. ASBESTOS SIDING. CEILED INSIDE. PLATFORM AT ONE SIDE.	146							
"	173	PRIMER & FUSE HOUSE. TYPE NO. 1	32×96	"	"	TILE WALLS, CEILED INSIDE. PLATFORM AT ONE SIDE.	173							
"	174	" " " " TYPE NO. 2	32×96	"	"	TILE WALLS, CEILED INSIDE. PLATFORM AT ONE END.	174							
"	152	PYROTECHNIC PLANT. TYPE D.	20×35		"	SALTPETER STORAGE. PLATFORM AT ONE END.	152							620-325
"	157	" " TYPE 16 D.	30×161	13'0"	"	BRICK END WALLS, RECEIVING AND DISCHARGING ROOMS & BENCH WORK.	157							620-325
"	158	" " TYPE 6 & 12	30×104		"	BRICK END WALLS, RECEIVING AND DISCHARGING ROOMS & BENCH WORK.	158							620-325
"	165	SHED, DOCK TYPE NO. 2	60×221	20'0"	"	TILE WALLS, STEEL TRUSSES. PLATFORMS AT END AND SIDE.	165		165					620-325
"	19	SHOP, ORDNANCE REPAIR.	30×80		"	OPTICAL, VEHICLE REPAIR, SADDLER, CARPENTER, ARMORER & MACH GUN RM.	19		19					620-325
"	158	STORAGE BATTERY STATION. TYPE NO. 1.	39×156	20'0"	"	TILE WALLS, WOOD TRUSSES. METAL WINDOWS. PLATFORMS.	158		158					620-325
"	43	STORAGE BUILDING VEHICLES. TYPE NO. 1.	113×513	16'0"	"	TILE WALLS, BRICK FIRE WALLS, METAL WINDOWS. PLATFORM.	43							620-325
"	188	STORAGE BUILDING VEHICLES. TYPE NO. 3.	161×VAR	"	"	TILE WALLS, BRICK FIRE WALLS METAL WINDOWS. PLATFORMS	188		188					620-325
"	41	STOREHOUSE GENERAL. TYPE NO. 1.	161×501	20'0"	"	TILE WALLS, BRICK FIRE WALLS, METAL WINDOWS. PLAT. BOTH SIDES.	41							620-325
"	74	TYPE NO. 2	161×VAR	20'0"	"	TILE WALLS, BRICK FIRE WALLS, METAL WINDOWS. PLAT. BOTH SIDES.	71		71					620-325
6271	7	STORAGE DEPOT, ADM. BLD'G.	140×160	"	2 STR'S.	BRICK WALLS, SHED ATTACHED. PLATFORMS. SEE PLAT PLAN GETI-5	7	5	10					
"	12	" " OPEN SHED.	139' 1280	"	1 STORY.	CINDER PLATFORM.	12	5	12					
"	17	" " WAREHOUSES. NO. 2-3-4-5-6-7-8	161×VAR	"		BRICK WALLS, CHARGING STATION, PLATFORM, TOILETS & ETC.	17	5	12					
608	24	THEATRE, CLASS-A.	120×187	"		SEATING CAP. OVER 3000.	25 25	26 27	30				6316 101	31
"	34-32-33 346 106	" LIBERTY CLASS-D.	75×167	15'6"		SEATING CAP. 2100 WITH BALCONY.	31 32	33 106	31 32	31				31
652	81	TRANSFORMER STA. TYPE NO. 1.	20×36		1 STORY.	BRICK WALLS, CONCRETE ROOF AND METAL WINDOWS.	81		81					620-325
6399	120	WELFARE BLD'G.	84×96	10'0"	"	AUDITORIUM, SEATING CAP. 200. BILLIARD & READING ROOMS.	120		103	103			6316 101	



PORTION OF WEST ELEVATION.



BUILT IN EQUIPMENT.
A Tables
B Delivery Bin
C Bin
D Marking Booths
E Receiving & Ship. Trucks.
(F) Assorting Trucks (G) Assorting Bin.
(H) Hats, Clothes Rack. (I) Stand.

SCHEDULE of LAUNDRY MACHINERY.

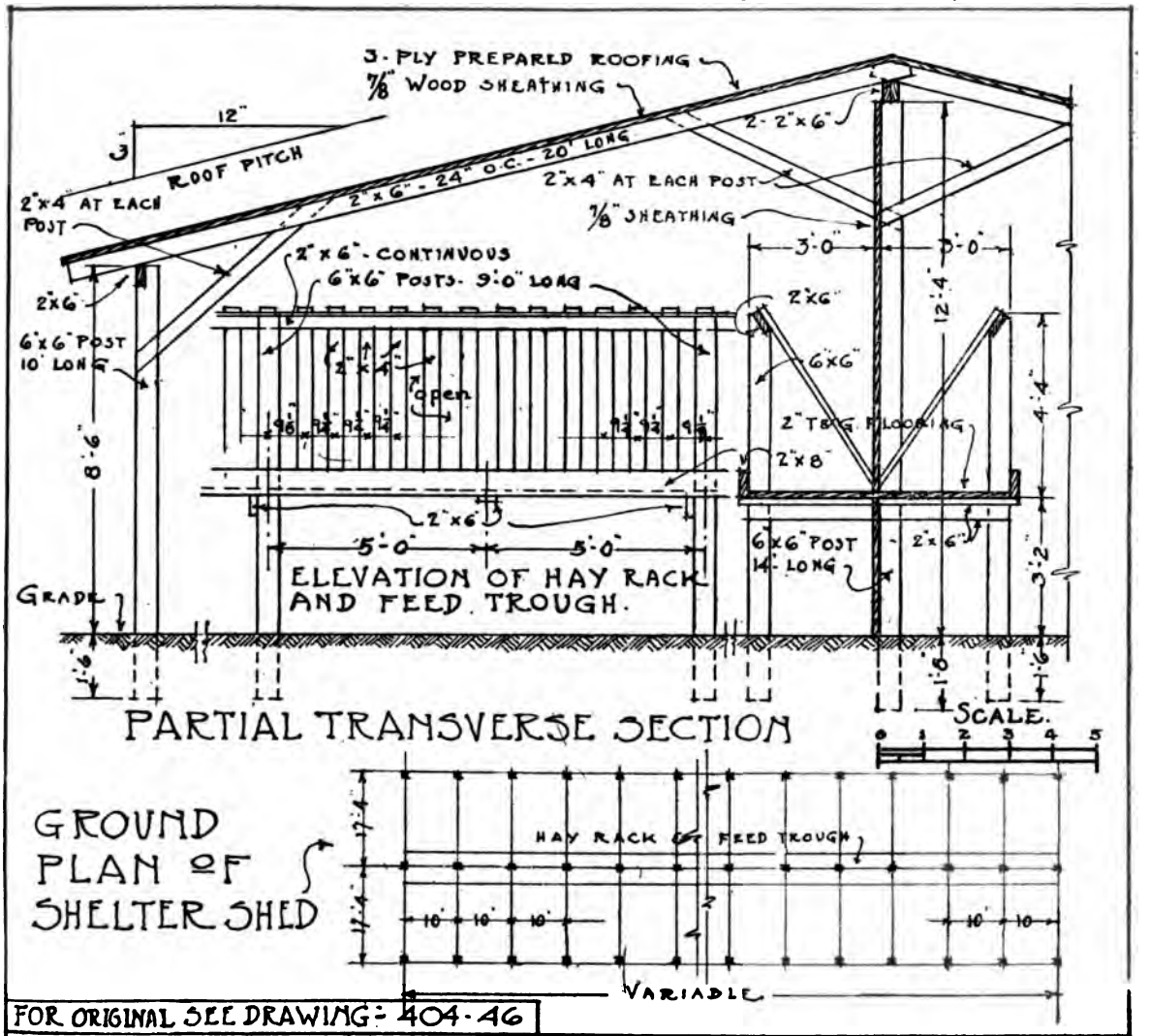
1	18	Receiving & Shipping Rm. Trucks.
3	4000	Marking Tags with Pins - 20 Pins per Tray.
4	12	40 x 72" Iron Frame Washing Machines
5	4	36 x 48" " " "
	2	30 x 30 " " "
6	12	28" Solid Curb Extractors, or 12-30" Extract.
	1	20" " " "
7	10	90 Gal. Soap Tanks
8	1	Set (3) Stationary Laundry Tubs.
9	20	Metal Wash Room Trucks.
10	6	40 x 90 Steam Drying Tumblers 2 Compts.
12	1	2 Door Truck Dry Rm. - Collar Bars.
14	3	120" C. Roll Flatwork Ironers - Feeding Tab.
17	1	66" Single Roll Flatwork Ironer.
18	30	38" Presses Ironing Machines in Tandem
19	1	160' Garment Conveyor.
20	18	Sorting bins on Trucks
21	1	26 Gal. Starch Cooker
22	1	14" Collar Starch Machine
23	1	Set (3) Starch Dip Bowls - Galv.
24	1	12" Collar Dampening Machine
25	1	Dampening Press
27	1	24" Steam Collar Ironer, two pass.
28	1	30 x 96" Shaping Table - No Motor.
	1	Turn Down Collar Shaper - Auto pressure
	1	Sleeve Type Edger - Electric.
29	1	Double Cuff Press Machine
30	1	Combined Bond & Yoke Press
32	1	Steam Bosom Press Machine
33	1	Steam Body Press
34	2	Shirt Finishing Tables with Elec. Irons.
35	3	Ironing Boards " "
36	36	12 Bushel Canvas Baskets
37	4	Repair Sewing Machines
38	1	Button "
39	2	Sock Darning "
40	2	40 H.P. Line Shaft Motors - 900 R.P.M., (Shafting, Couplings - Etc. not included)

Boiler H.P. for Laundry Machines only 140 H.P.
not including Steam for Heating Water @ 90# P.
Total Elect. H.P. for Motors & Heating elements but not Includ. Lights or other Apparatus - 96 H.P.
Cold Water for Laundry Machines only 4200 Gal. per Hour. not includ. Boiler & other requirements.
Hot Water for Laundry Machines only 3600 Gals. per hour.

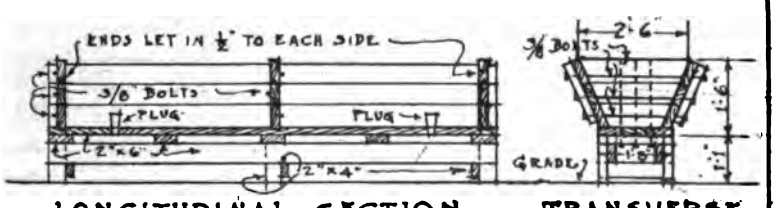
Scale 0 8 16 24 32 40

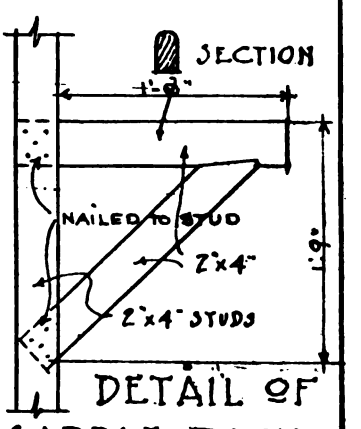
For Original See Drawing 639-110.

CONSTRUCTION DIVISION OF THE ARMY
STANDARD LAUNDRY
CAPACITY 10,000 TO 20,000 MEN



FOR ORIGINAL SEE DRAWING 404-46





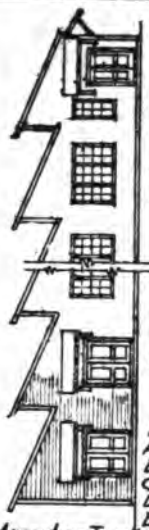
FOR ORIGINAL SEE DRAWING 620-423.

CONSTRUCTION DIVISION OF THE ARMY
REMOUNT STATIONS
SHELTER SHED·WATER TROUGH & SADDLE RACK

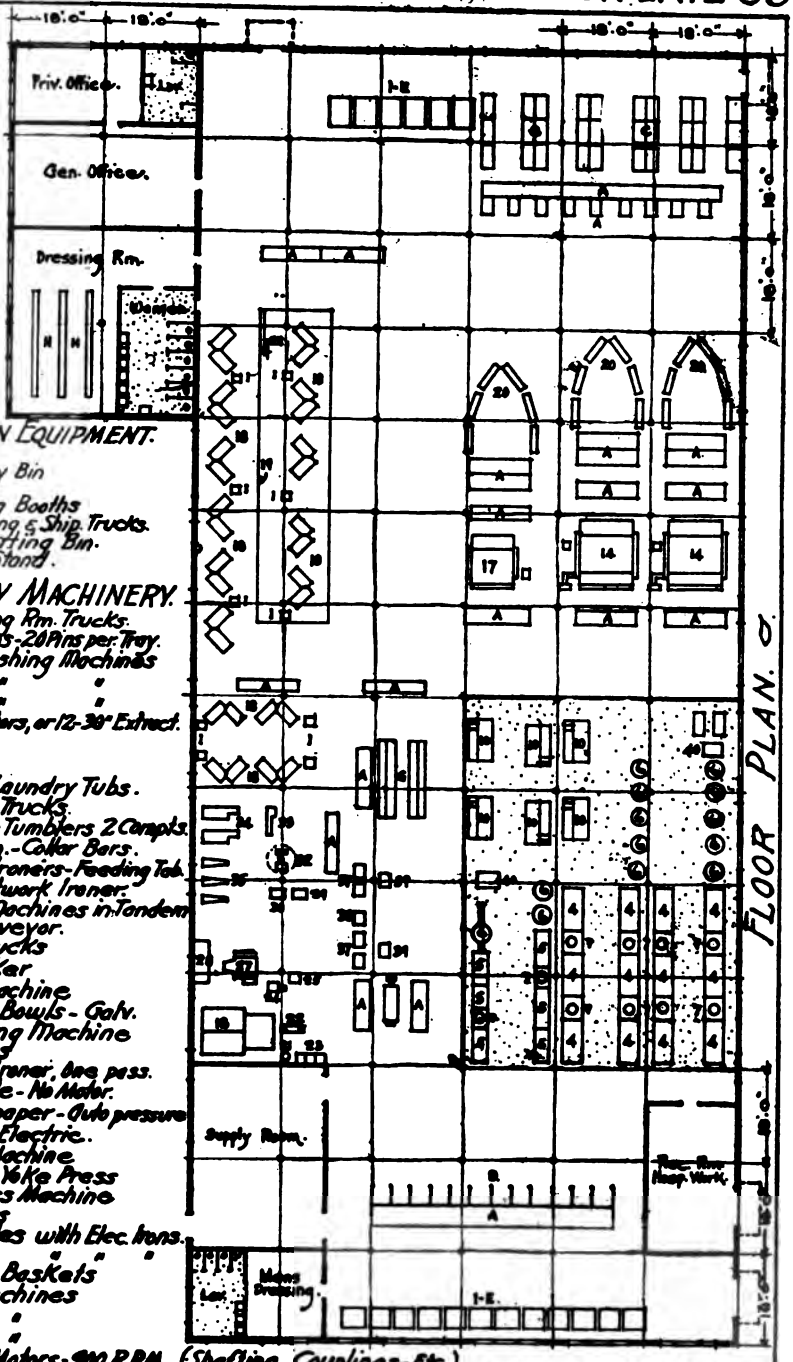
MISCELLANEOUS-BUILDINGS-DESCRIPTION & REFERENCE-DRWGS

NOTE: REFERENCE DRAWINGS HAVE SAME JOB NUMBER UNLESS OTHERWISE NOTED.

JOB	DRWG	NAME OF BUILDING	SIZE	BENTS	HEIGHT	NOTES (UNLESS OTHERWISE NOTED ALL BLD'GS ARE OF WOOD CONST.	CONSTN. DETAILS.		ELEC.	PLUMB.	HOT WATER	STEAM HEAT.	STOVE HEAT.	VENTS.
608	18-20 21-22	AUDITORIUM.	200×300	23'0"		FRAME & STUCCO, PLASTERED INSIDE, STEEL TRUSSES AND WOOD ROOF.	20 21	22	29			41		620-325
6339	131	CAFETERIA.	54×189	14'6"	1 STORY.	TWO DINING ROOMS 54×59', KITCHEN AND STORE ROOMS.	133	134	131	131		131		
6370	106	"	132×173	12'0"	2 STR'S.	CAP. OFFICERS 118, MEN 417, WOMEN 712, KITCHEN AND BED ROOMS FOR 20 BEDS.	106	108	106	105	105	109		620-325
6209	113	"	105×192	16'0"	1 STORY.	4 DIN'G RMS, SEATS 244 EACH, KITCHEN & STORE RMS, CAP. 2000	112	113	112	112	112		620 329 330	620-325
6383	110	"	110×171		"	2 DIN'G RM'S SEATS 194 EACH } KITCHEN 2 " " " 102 " } & ETC.	111	112	112	110	110	112		620-325
6403	111	"	156×200		2 STR'S	MENS DIN'G. RM. SEATS 1000 } KITCHEN WOMEN " " " 500 } & ETC.	111	113	101	101		114		620-325
632	551	DELOUSING PLANT.	48×84	12'0"	1 STORY	24 MEN PER. ½ HOUR.	551		551	591	591	591		620-325
"	550	" "	54×120	"	"	48 MEN PER. ½ HOUR	550		550	590	590	590		620-325
"	552	" "	60×204	"	"	130 MEN PER. ½ HOUR.	552		552	589	589	589		620-325
6307	110	DORMITORY FOR MEN.	28×113	15'0"	2 STR'S.	47 SINGLE BED ROOMS, SOCIAL HALL 14'×22' & ETC.	6316 103		110	110	110		6316 101	
"	121	DORMITORY & DINING ROOM.	29×136	"	"	58 SINGLE BED ROOMS } KITCHEN DINING ROOM 28'×29' } & ETC.	6316 103		121	121	121		6316 101	
6339	111	" " "	29×136	"	"	60 SINGLE BED ROOMS } SERVING RM DINING ROOM 29'×30' } & ETC.	6316 103		111	111	111		6316 101	
6242	5	GARAGE MECHANICAL REPAIR UNIT NO. 305.	140×144	16'0"	1 STORY		5		5	5				620-325
6311	105	" SCITUATE PROVING GROUNDS. MASS.	61×164	18'0"	"	BRICK WALLS & WOOD TRUSSES.	106		158	105				620-325
652	17	" ORDNANCE.	50×VAR.	20'0"	"	TILE WALLS, WOOD TRUSSES. HEATER ROOM.	17		17	17		17		620-325
"	214	GUARD HOUSE, TYPE NO. 1	20×56	7'0"	"		214		214	214			620 329 330	
6143	2	GAS INSTRUCTION.	16×30		"		2							
6309	121	HOUSING, 4 FAMILY HOUSE	38×53		2 STR'S.	KITCHEN, LIVING ROOM & TWO BED ROOMS. } EACH	102 103	104	105	105			6316 101	
"	180	" 1 " "	24×26		"	KITCHEN, DINING RM, LIVING RM. AND THREE BED ROOMS.	102 103	104	105	105			6316 101	
"	160	" BOARDING "	27×38		"	KITCHEN, LIVING ROOM AND EIGHT BED ROOMS.	102 103	104	105	105			6316 101	
"	150	" 1 FAMILY. "	24×30		1 STORY	KITCHEN, LIVING RM. & TWO BED RMS.	102 103	104	105	105			6316 101	
"	190	" 1 " "	24×32		"	KITCHEN, LIVING ROOM AND TWO BED ROOMS.	102 103	104	105	105			6316 101	
"	200	" 2 " "	25×36		2 STR'S.	KITCHEN, DINING, LIVING AND THREE BED ROOMS } EACH.	102 103	104	105	105			6316 101	
633	140	LAUNDRY.	36×108	18'0"	1 STORY	1000 TO 2000 MEN.	101	102	140	142	141	141		
"	130	"	72×216	"	"	5000 TO 10000 MEN.	101	102	130	132	131	131		
"	110	"	144×252	"	"	10000 TO 20000 MEN.	101	102	110	112	111	111		
"	120	"	210×170	"	"	40000 MEN.	101	102	120	122	121	121		
608	104	LECTURE HALL.	51×77	15×0		SEATING CAP. 500.	104		670 367				620 325 330	620-325
652	7	MAGAZINE-TYPE NO. 1.	51×219	20'0"	1 STORY	TILE WALLS & WOOD TRUSSES.	7							620-325
"	9	" " NO. 2.	51×219	"	"	" " " "	9							620-325
"	179	" " NO. 10	49×208	16'0"	"	TILE OR BRICK WALLS.	179							620-325
"	180	" FOR HIGH EXPLOSIVES. NO. 11	26×42		"	TILE WALLS, CEILED INSIDE. PLATFORM AT ONE END.	180							
"	31	" NO. 12	26×42		"	CORR. ASBESTOS OR GALV. IRON SIDING. CEILED INSIDE. PLATFORM AT ONE END.	31							
"	169	" FOR HIGH EXPLOSIVES. NO. 13.	26×42		"	TILE WALLS, CEILED INSIDE. PLATFORM AT ONE END.	169							
6196	104	" BLACK POWDER.	16×22		"	CORR. ASBESTOS SIDING. CEILED INSIDE.	104		104					
652	146	" SMOKELESS POWDER. NO. 18	32×96	16'0"	"	CORR. ASBESTOS SIDING. CEILED INSIDE. PLATFORM AT ONE SIDE.	146							
"	173	PRIMER & FUSE HOUSE. TYPE NO. 1.	32×96	"	"	TILE WALLS, CEILED INSIDE. PLATFORM AT ONE SIDE.	173							
"	174	" " " " TYPE NO. 2.	32×96	"	"	TILE WALLS, CEILED INSIDE. PLATFORM AT ONE END.	174							
"	152	PYROTECHNIC PLANT. TYPE D.	20×35		"	SALTPETER STORAGE. PLATFORM AT ONE END.	152							620-325
"	157	" " TYPE 1 & 1A	30×161	13'×0"	"	BRICK END WALLS, RECEIVING AND DISCHARGING ROOMS & BENCH WORK.	157							620-325
"	158	" " TYPE 3 & 3A	30×104		"	BRICK END WALLS, RECEIVING AND DISCHARGING ROOMS & BENCH WORK.	158							620-325
"	165	SHED, DOCK TYPE NO. 2	60×221	20'×0"	"	TILE WALLS, STEEL TRUSSES. PLATFORMS AT END AND SIDE.	165		165					620-325
"	19	SHOP, ORDNANCE REPAIR.	30×80		"	OPTICAL, VEHICLE REPAIR, SADDLER, CARPENTER, ARMORER & MACH GUN RM'S	19		19					620-325
"	158	STORAGE BATTERY STATION. TYPE NO. 1.	39×156	20'×0"	"	TILE WALLS, WOOD TRUSSES. METAL WINDOWS. PLATFORMS.	158		158					620-325
"	43	STORAGE BUILDING VEHICLES. TYPE NO. 1.	13×513	16'×0"	"	TILE WALLS, BRICK FIRE WALLS, METAL WINDOWS. PLATFORM.	43							620-325
"	188	STORAGE BUILDING VEHICLES. TYPE NO. 3.	161×VAR	"	"	TILE WALLS, BRICK FIRE WALLS METAL WINDOWS. PLATFORMS	188		188					620-325
"	41	STOREHOUSE GENERAL. TYPE NO. 1.	161×501	20'×0"	"	TILE WALLS, BRICK FIRE WALLS, METAL WINDOWS. PLAT. BOTH SIDES.	41							620-325
"	74	TYPE NO. 2	161×VAR	20'×0"	"	TILE WALLS, BRICK FIRE WALLS, METAL WINDOWS. PLAT. BOTH SIDES.	71		71					620-325
6271	7	STORAGE DEPOT, ADM. BLDG.	140×160	"	2 STR'S.	BRICK WALLS, SHED ATTACHED. PLATFORMS. SEE PLAT PLAN 6271-5	7	5	10					
"	12	" " OPEN SHED.	153' 1200	"	1 STORY	CINDER PLATFORM.	12	5	12					
"	17	" " WAREHOUSES. NO. 2-3-4-5-6-7-8	161×VAR.	"		BRICK WALLS, CHARGING STATION, PLATFORM, TOILETS & ETC.	17	5	12					
608	24	THEATRE, CLASS-A.	120×187	"		SEATING CAP. OVER 3000.	25 25	26 27	30				6316 101	31
"	31-32-33 346 106	" LIBERTY CLASS-D.	75×167	15'6"		SEATING CAP. 2100 WITH BALCONY.	31 32	33 106	31 32	31				31
652	81	TRANSFORMER STA. TYPE NO. 1.	20×36		1 STORY	BRICK WALLS, CONCRETE ROOF AND METAL WINDOWS.	81		81					620-325
6399	120	WELFARE BLD'G.	84×96	10'0"	"	AUDITORIUM, SEATING CAP. 200. BILLIARD & READING ROOMS.	120		103	103			6316 101	



PORTION OF WEST ELEVATION.



BUILT IN EQUIPMENT.
A Tables
B Delivery Bin
C Bin
D Marking Booths
E Receiving & Ship. Trucks.
(F) Assorting Trucks (G) Assorting Bin.
(H) Hats, Clothes Rack. (I) Stand.

SCHEDULE of LAUNDRY MACHINERY.

1	18	Receiving & Shipping Rm. Trucks.
3	4000.	Marking Tags with Pins-20 Pins per Tray.
4	12	40x72" Iron Frame Washing Machines
5	4	36x48" " " "
	2	30x30 " " "
6	12	28" Solid Curb Extractors, or 12-30" Extract.
	1	20" " "
7	10	90 Gal. Soap Tanks
8	1	Set (3) Stationary Laundry Tubs.
9	20	Metal Wash Room Trucks.
10	6	40x90 Steam Drying Tumblers 2 Compts.
12	1	2 Door Truck Dry Rm.-Collar Bars.
14	3	120"C. Roll Flatwork Ironers-Feeding Tab.
17	1	44" Single Roll Flatwork Ironer.
18	30	38" Press Ironing Machines in Tandem
19	1	160' Garment Conveyor.
20	18	Sorting bins on Trucks
21	1	26 Gal. Starch Cooker
22	1	14" Collar Starch Machine
23	1	Set (3) Starch Dip Bowls - Galv.
24	1	12" Collar Dampening Machine
25	1	Dampening Press
27	1	24" Steam Collar Ironer, one pass.
28	1	30x96" Shaping Table - No Motor.
	1	Turn Down Collar Shaper - Auto pressure
	1	Sleeve Type Edger - Electric.
29	1	Double Cuff Press Machine
30	1	Combined Bond & Yoke Press
32	1	Steam Bosom Press Machine
33	1	Steam Body Press
34	2	Shirt Finishing Tables with Elec. Irons.
35	3	Ironing Boards " "
36	36	12 Bushel Canvas Baskets
37	4	Repair Sewing Machines
38	1	Button "
39	2	Sock Darning "
40	2	40 H.P. Line Shaft Motors - 900 R.P.M., (Shafting, Couplings - Etc.)

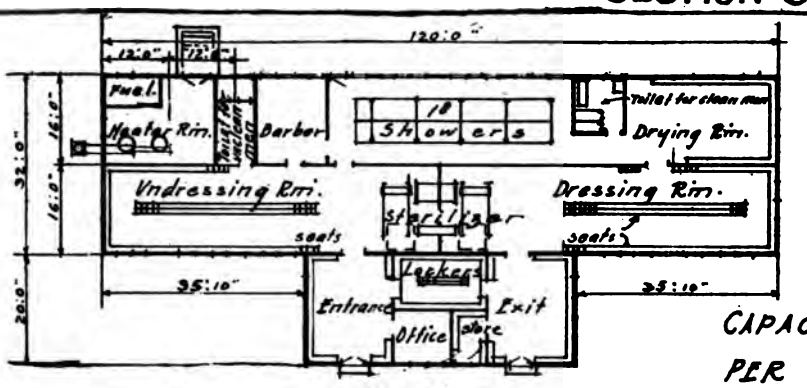
Boiler H.P. for Laundry Machines only 140 H.P. not including Steam for Heating Water @ 90# P.
Total Elect. H.P. for Motors & Heating elements but not includ. Lights or other Apparatus - 96 H.P.
Cold Water for Laundry Machines only 4200 Gal. per Hour. not includ. Boiler & other requirements.

Hot Water for Laundry Machines only 3600 Gals. per hour.

Scale 0 8 16 24 32 40

For Original See Drawing 639-110.

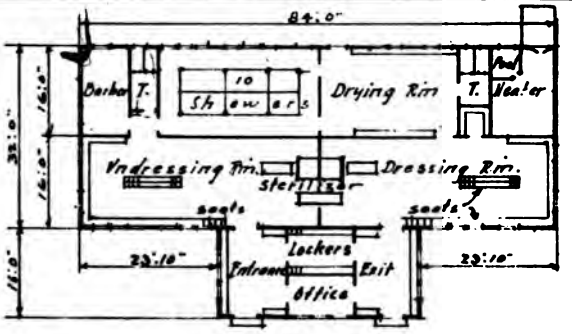
CONSTRUCTION DIVISION OF THE ARMY
STANDARD LAUNDRY
CAPACITY 10,000 TO 20,000 MEN



PLAN

CAPACITY 48 MEN PER HALF HOUR

FOR ORIGINAL SEE DRAWING C32-550



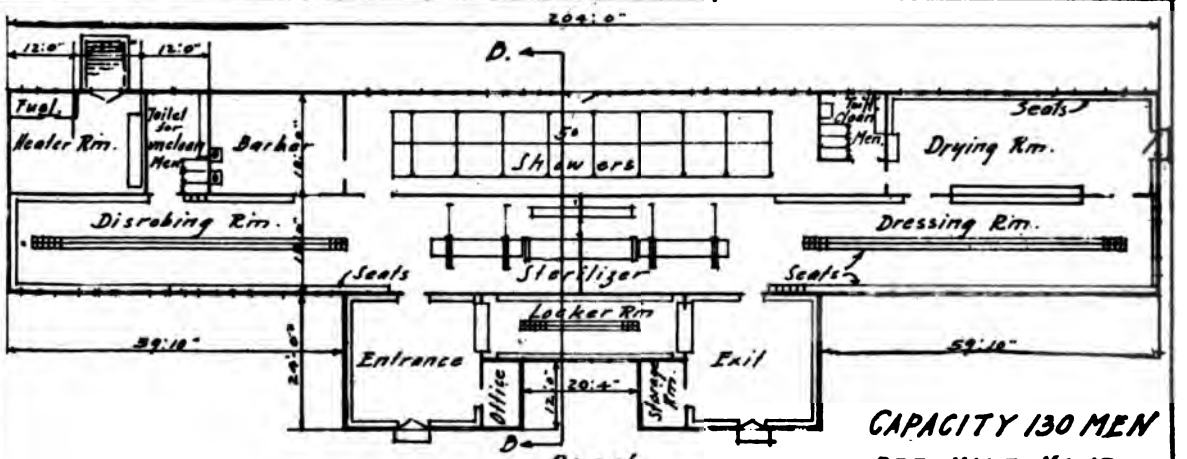
PLAN

SCALE

0 10 20 30 40 50

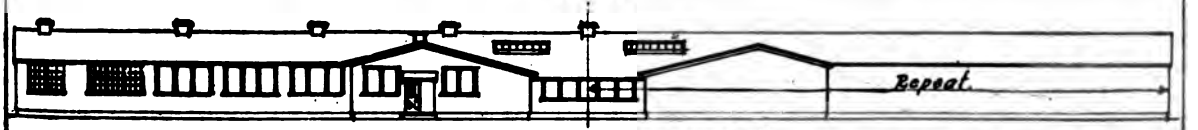
CAPACITY 24 MEN PER HALF HOUR

FOR ORIGINAL SEE DRAWING C32-551

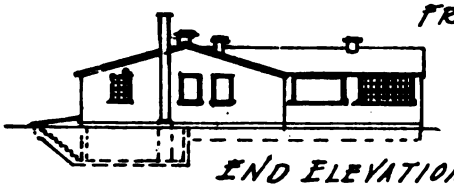


PLAN

CAPACITY 130 MEN PER HALF HOUR.



FRONT ELEVATION

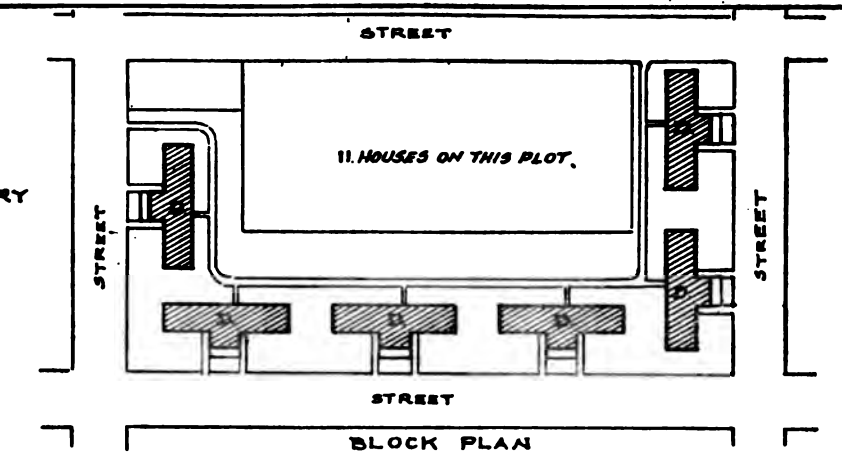


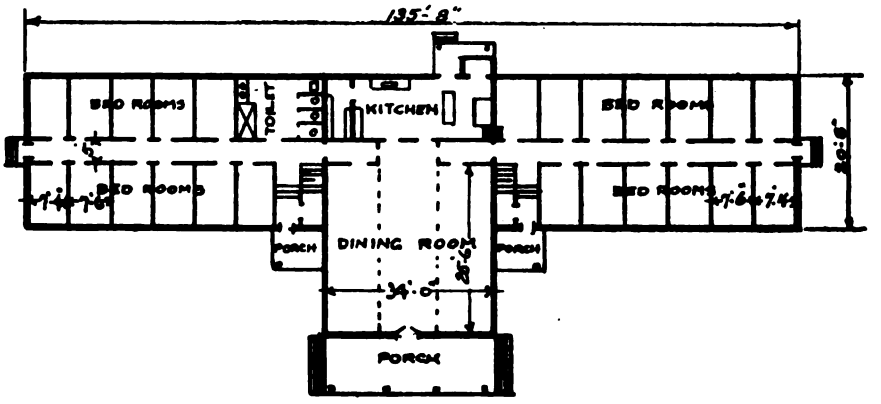
END ELEVATION

SECTION B-B.

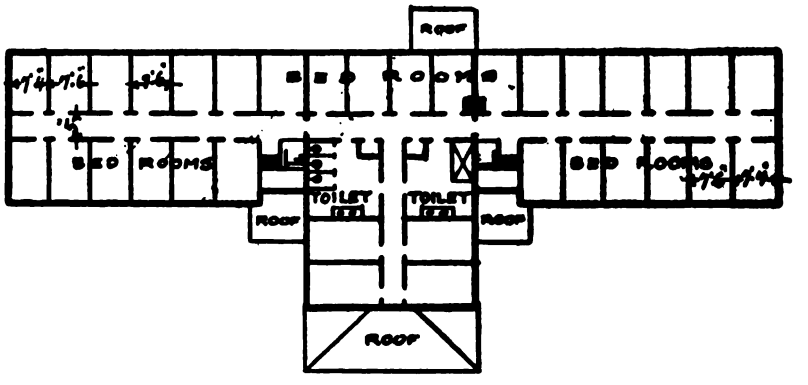
FOR ORIGINAL SEE DRAWING C32-550.

CONSTRUCTION DIVISION OF THE ARMY
TYPES OF DELOUSING PLANTS
VARYING CAPACITIES





FIRST FLOOR PLAN
DORMITORY



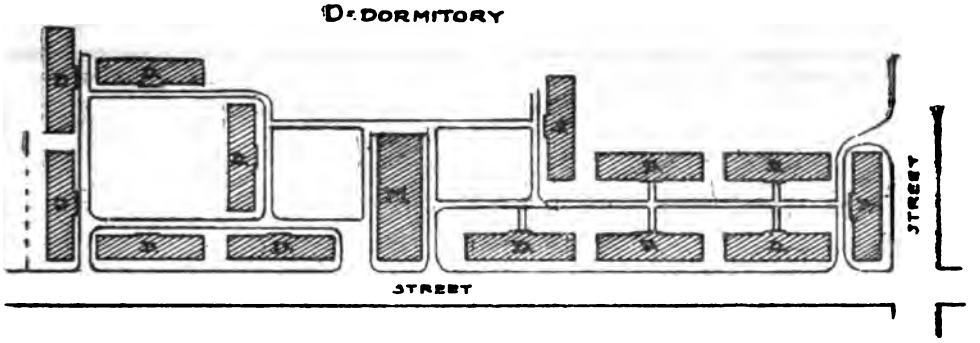
SECOND FLOOR PLAN
DORMITORY

SCALE
0' 8' 16' 24' 32' 40'

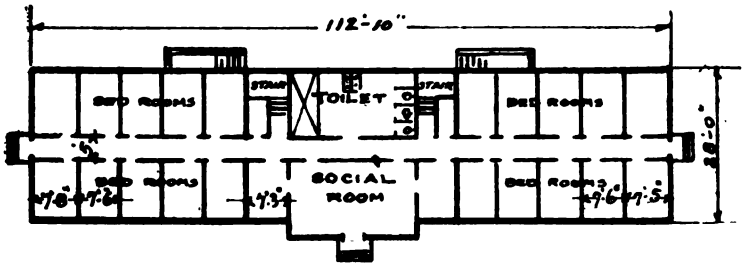
FOR ORIGINAL SEE DRWGS 6507-102-121.

CONSTRUCTION DIVISION OF THE ARMY
INDUSTRIAL HOUSING
DORMITORIES WITH MESS.

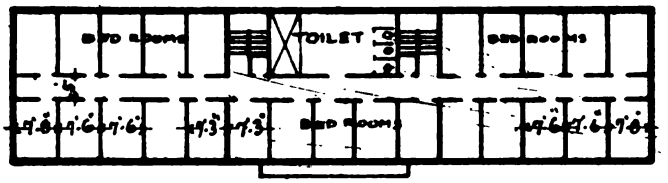
M = MESS HALL
D = DORMITORY



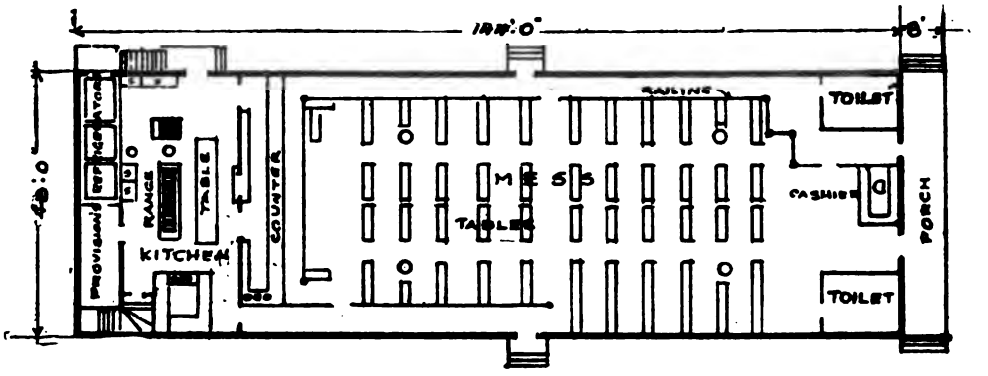
BLOCK PLAN



PLAN OF FIRST FLOOR
DORMITORY
"D"



PLAN OF SECOND FLOOR

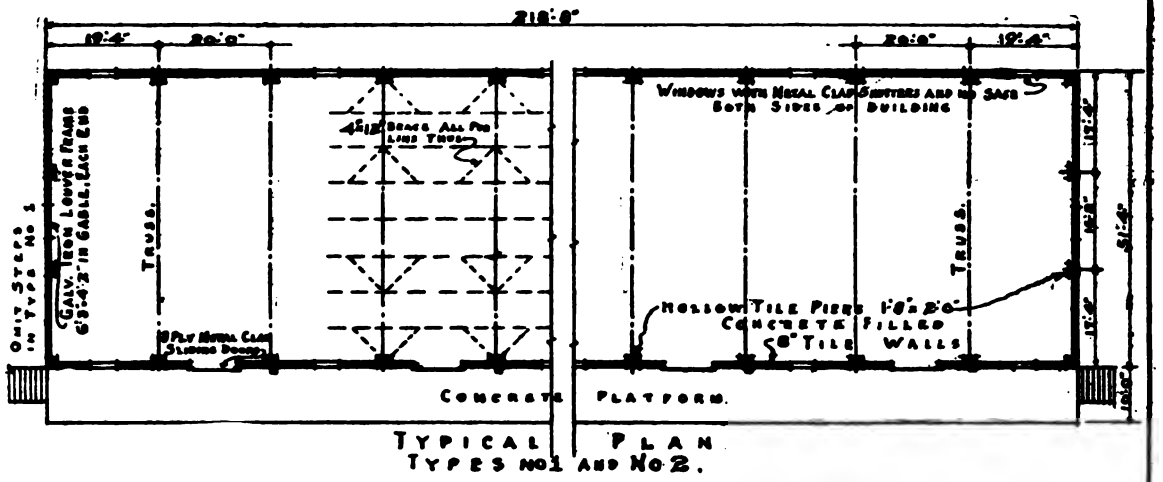


FLOOR PLAN
MESS HALL
"M"

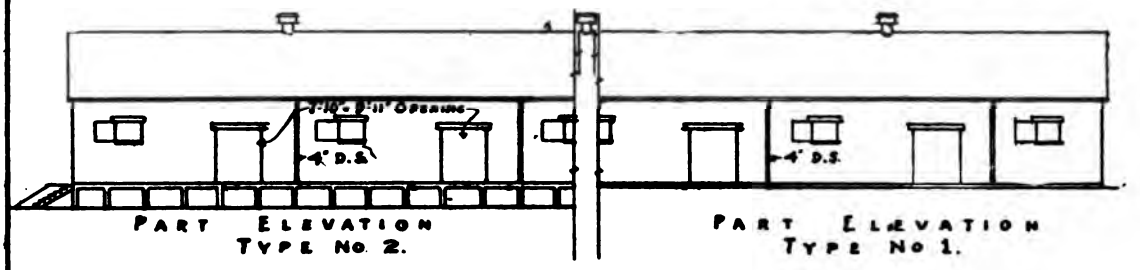
SCALE
0 8' 16' 24' 32' 40'

FOR ORIGINAL SEE DRWGS 6307-101-110-140.

CONSTRUCTION DIVISION OF THE ARMY
INDUSTRIAL HOUSING
DORMITORIES & DETACHED MESS BLDG.

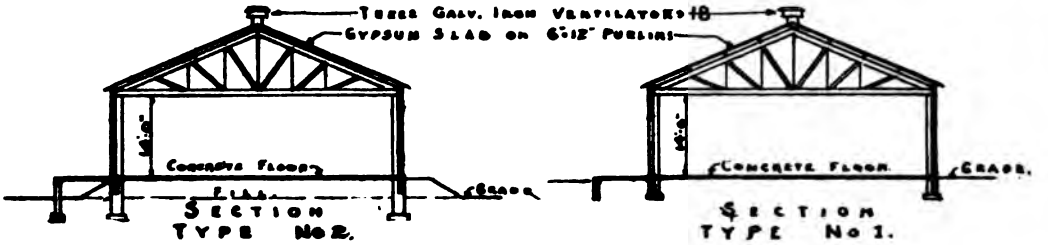

218'-8"
19'-4"
20'-0"
20'-0"
19'-4"
Omit Steps in Type No 1
Galv. Iron Louver Frame 6'3-4" in Gable, Each End
Trusses
4"x12" Beams All Pine Long Thick
Windows with Metal Clad Shutters and No Sash Both Sides of Building
Trusses
Hollow Tile Piers 16" O.C. Concrete Filled 8" Tile Walls
Concrete Platform.

TYPICAL PLAN
TYPES NO 1 AND NO 2.



PART ELEVATION
TYPE NO. 2.

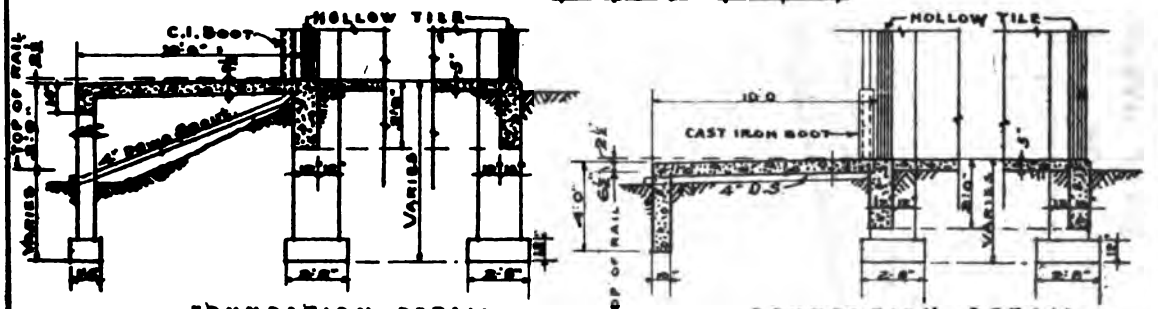
PART ELEVATION
TYPE NO 1.



SECTION
TYPE NO 2.

SECTION
TYPE NO 1.

SCALE
0 10 20 30 40 50



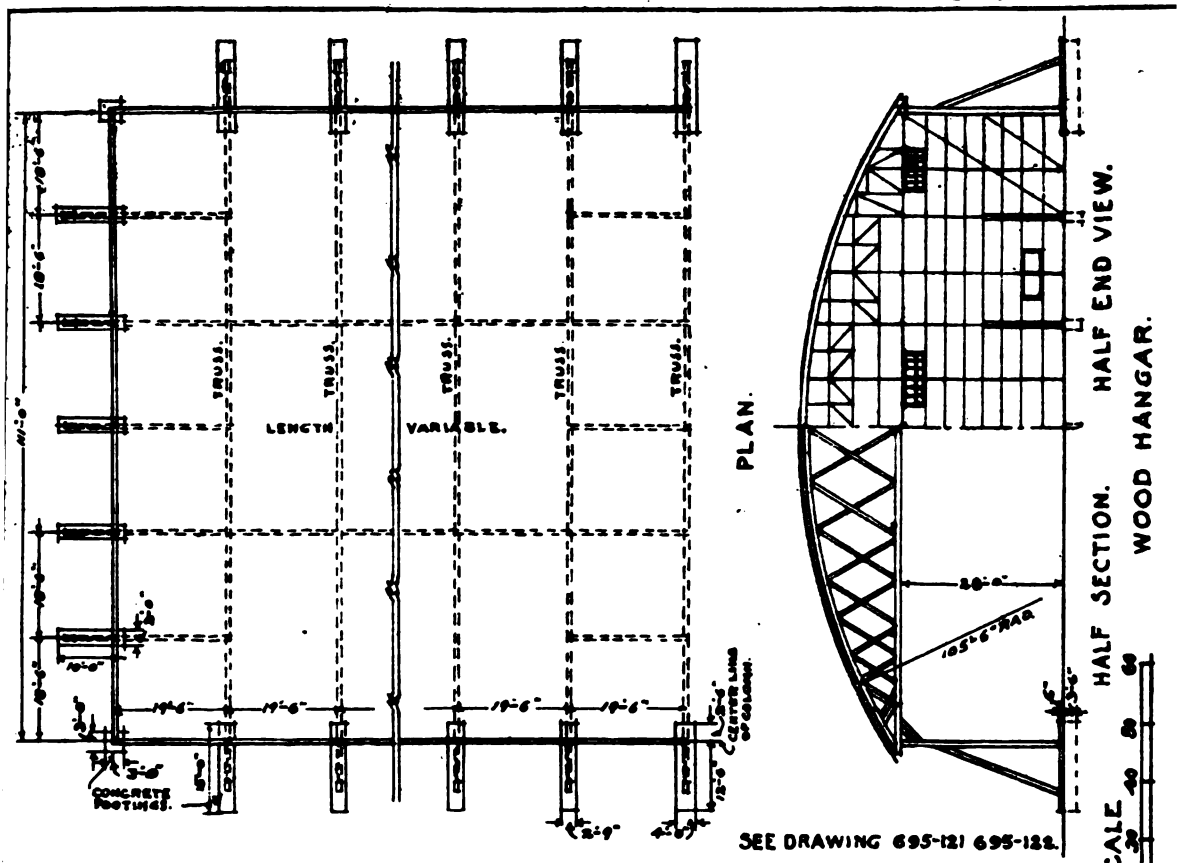
FOUNDATION DETAIL
TYPE NO 2.

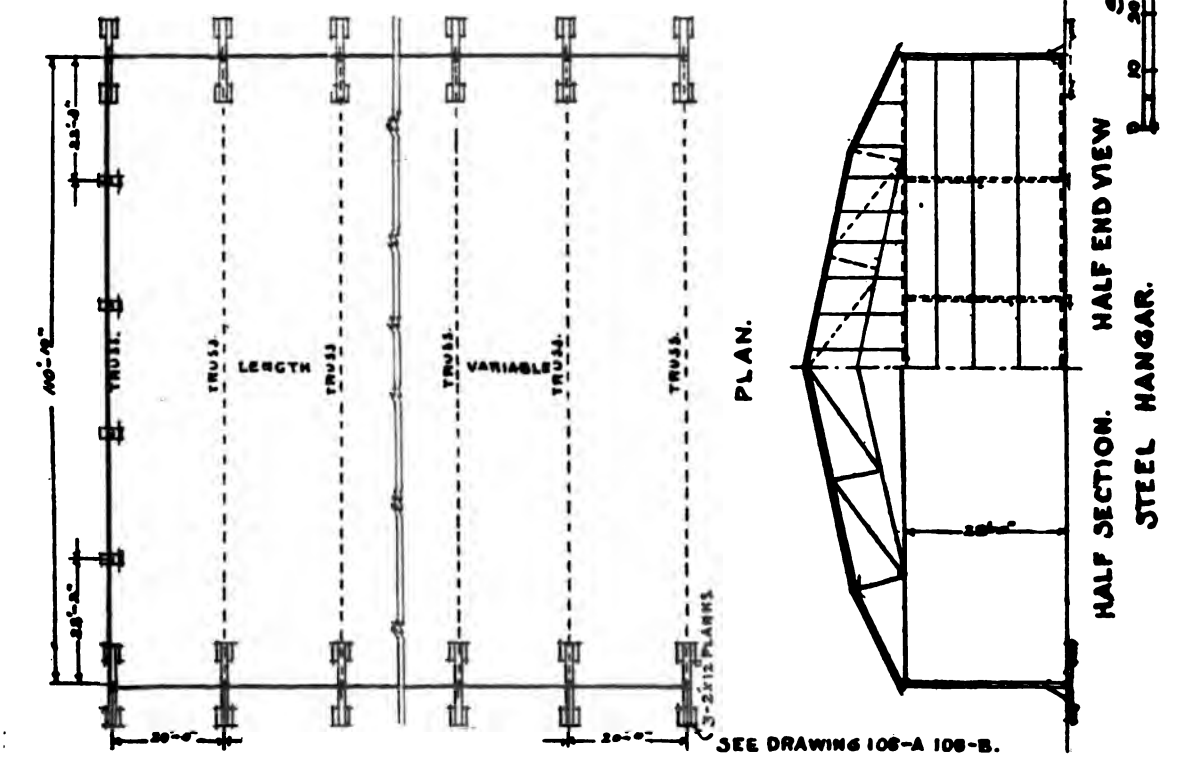
FOUNDATION DETAIL
TYPE NO 1.

CARRY FOOTINGS DOWN TO FIRM SOIL

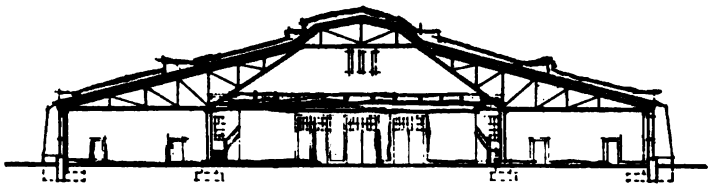
FOR ORIGINAL SEE DRAWING { 652-7 FOR TYPE NO 1.
652-9 FOR TYPE NO 2.

CONSTRUCTION DIVISION OF THE ARMY
STANDARD MAGAZINES
TYPES NO 1 AND NO 2.



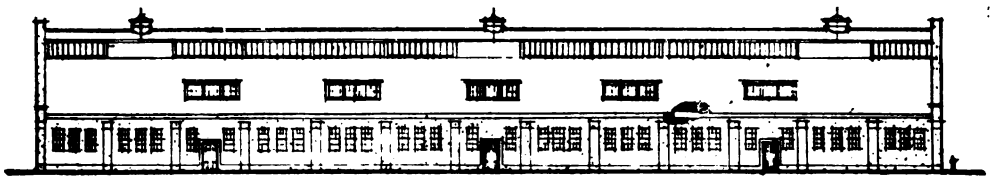


CONSTRUCTION DIVISION OF THE ARMY
STANDARD HANGARS
STEEL & WOOD

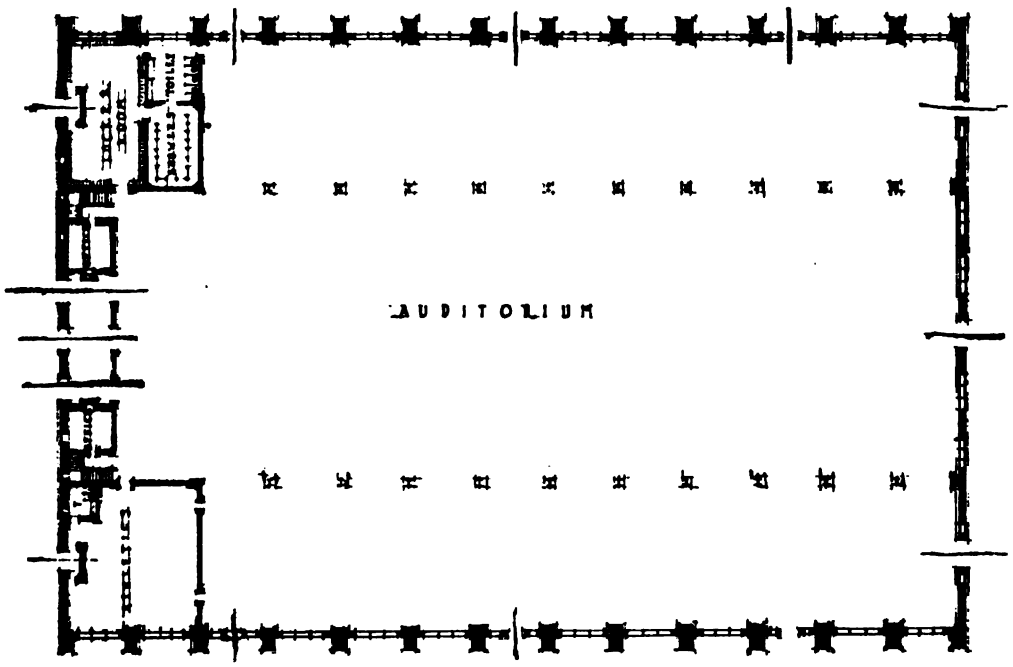


CROSS SECTION

FRONT ELEVATION



SIDE ELEVATION



FLOOR PLAN

SCALE.

FOR ORIGINAL SEE DRAWINGS 608-19-20-21-22.

CONSTRUCTION DIVISION OF THE ARMY

AUDITORIUM

200' x 300'

HOUSING.

TYPES OF BUILDINGS AND GROUPING.

The Construction Division designs and executes housing for troops. Housing for the civilian employees of industrial plants, munitions plants, shipbuilding plants, etc., with few exceptions, is provided through agencies other than the Construction Division.

In comparatively few instances, housing is an integral part of the War Department project and for such developments *drawings are available as follows:*

Dwelling houses ranging from the simplest type designed for the negro laborer, to officers' quarters suitable for permanent Army posts, which vary in accommodations of from three to eight rooms; boarding houses of eight rooms; dormitories with and without kitchens and dining-rooms, with accommodations for from fifty to sixty men; cafeterias of varying capacities; and in the case of group settlements, dependent buildings that are designed for use as stores, school and assembly purposes, post offices and fire stations.

Group settlements of dwellings with a limited number of dormitories and cafeteria, occur at Brunswick, Ga., in connection with the Picric Acid Plant, where it was necessary to provide accommodations for 3,000 white and negro workmen.

Group arrangement of dormitories occur at Bethlehem, Pa., and at Erie, Pa., Plate No.'s 70 and 71. The latter development shows the type and capacities of buildings generally used, and the relation of cafeteria or mess hall to dormitories built without kitchens and dining rooms.

While the above buildings have been designed to meet the needs of emergency projects and have been subject to war-time limitations as to materials, many of them are suitable for more permanent use than Standard Cantonment construction.

Standard Cantonment officers' quarters, barracks and mess buildings are adaptable to certain classes of emergency houses.

HOSPITALS.

GENERAL CONSIDERATIONS.

From the experience of building the Cantonments, there developed the understanding, since in effect between the Construction Division and the Surgeon General's Office, by which the latter office is informed whenever construction involving the housing of troops is about to be undertaken. An outline of hospital requirements is automatically furnished the Construction Division which prepares drawings, schedules and estimates, and secures the proper authority from the Staff.

The Construction Division has made it its policy to push hospital construction ahead of barrack construction. This includes the preparation of the design, provisions for utilities, scheduling the materials needed and instructions to constructing officers in the field.

Secondary to speed as a consideration in Hospital Construction is the choice of Site. This should be on high ground, and in the case of the Base Hospital, should be some distance from the Camp and located so as to avoid contaminating winds from the Remount and the less sanitary parts of the encampment. It is particularly essential that the site be well drained and with good sun exposure.

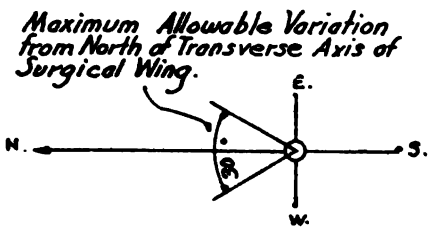
The Military Hospitals differ from Civilian Institutions in the provision of Quarters for Officers and Barracks for Enlisted men as well as accommodations for Nurses. In addition to buildings used for Administering the Hospital or for Housing or Feeding the patients or for Heating, there are buildings for special treatment, such as Physical Therapy, School and Curative Shops and Buildings for special administrative purposes, such as Guard House, Post Exchange, Fire House and Storehouses.

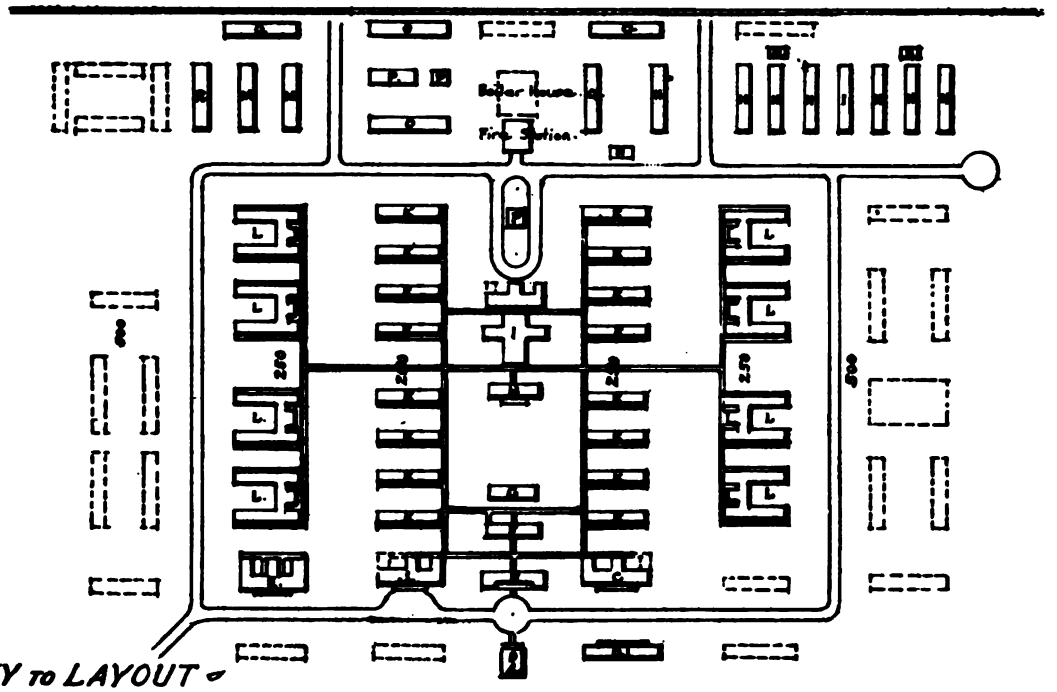
BASE HOSPITALS.

The first consideration in the construction of Base Hospitals, is the necessity of having buildings for medical or surgical treatment ready to receive patients as soon as troops are received in camp. The Pavilion Type of one-story ward and service buildings connected by corridors (designed by the Surgeon General's Office), was originally used for these Hospitals. A 1,000-bed Hospital of this type has been built complete with all utilities, in a little over two months.

GENERAL HOSPITALS.

In connection with General Hospitals, which are self-contained, there are additional considerations. Being located apart from the concentration of troops, questions of water supply, sewerage disposal, electric service, power plants, roads, etc., must be even more thoroughly studied than at the camps, where the utilities of the Hospital usually constitute extensions to facilities already provided. A very important consideration in connection with the construction of a General Hospital is the need of a railroad spur for hauling materials during construction and for bringing patients by rail to the Hospital after it has been put into operation.





KEY to LAYOUT

B	Administration
C	Officers Ward.
D4-D1	" Quarters.
E	Nurses "
F	Laboratory
G	Operating Pavilion
H	Post Exchange.
H	Garage — Shop.
I	Mess Kitchen
J	Receiving Ward
K	Single Ward
L	Ward & Lavatory
M	Isolation Ward
N	2 Story Hosp. Corps Barracks.
O	Store House
P	Chapel
P	Mortuary
P	Guard House
Q	Laundry
R	Neuro Psychiatric Ward
	Fire Station
	Boiler House
	Red Cross.

CAPACITY 1000 BEDS.

DOTTED LINES SHOW FUTURE BUILDINGS

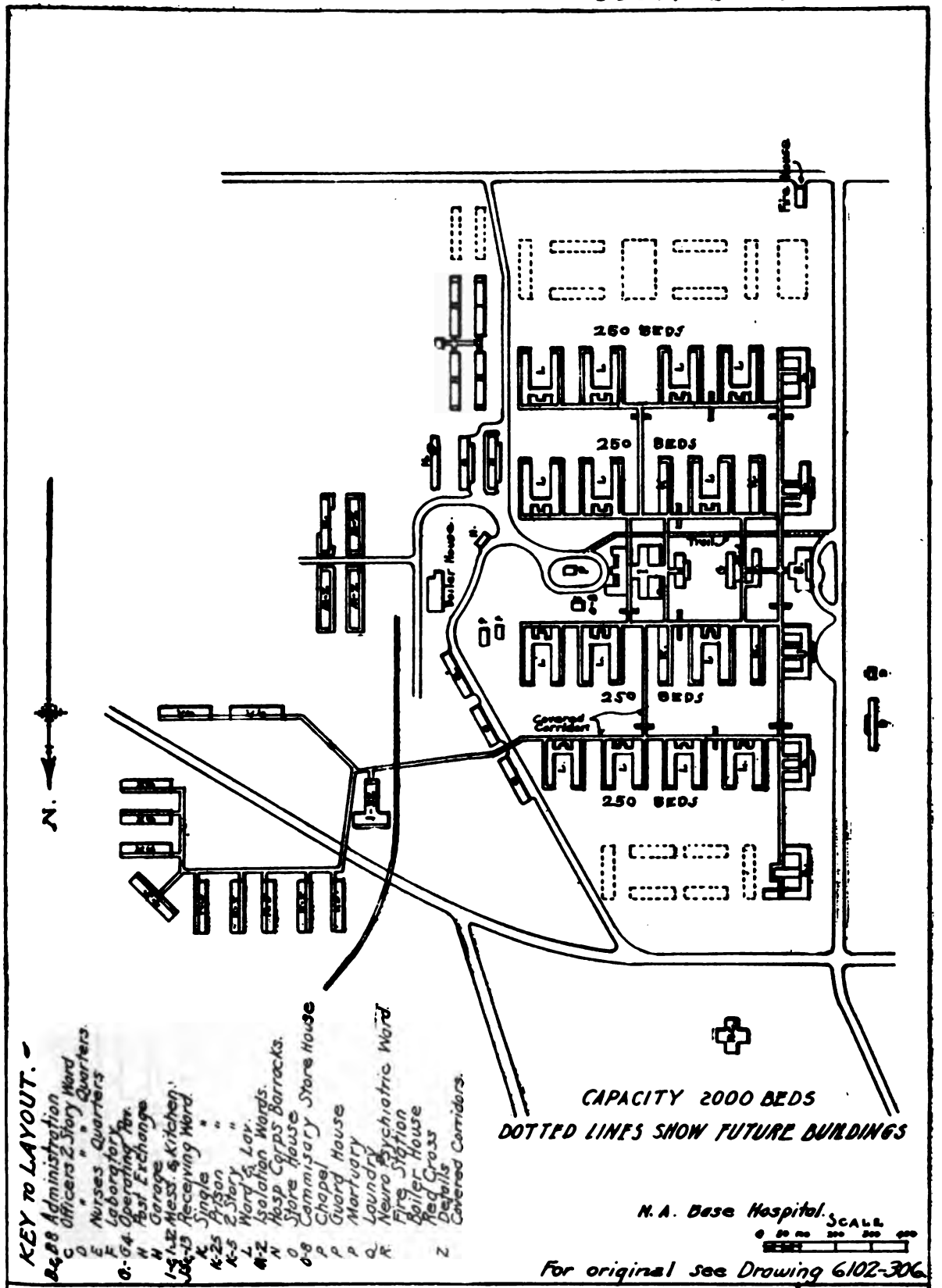
SCALE
0 50 100 200 300 400

For Original see Drawing 632-78.

CONSTRUCTION DIVISION OF THE ARMY

SCHEMATIC LAYOUT · PAVILION TYPE A

CONSTRUCTED FOR THE SURGEON GENERAL OF THE ARMY



CONSTRUCTION DIVISION OF THE ARMY

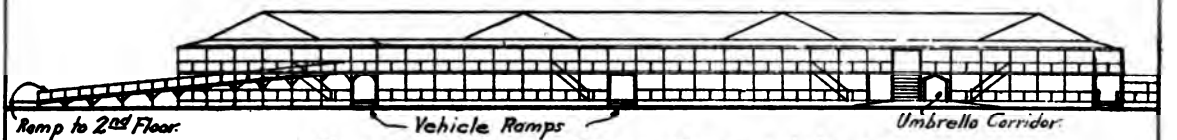
TYPICAL HOSPITAL LAYOUT

CAMP GORDON, ATLANTA, GEORGIA.

CONSTRUCTED FOR THE SURGEON GENERAL OF THE ARMY

A

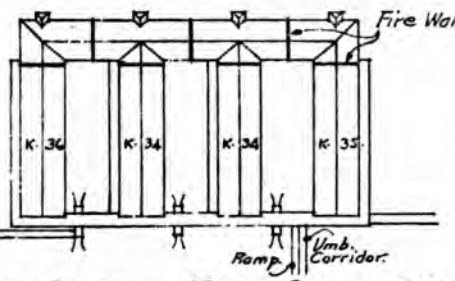
PLOT PLAN PAVILION TYPE



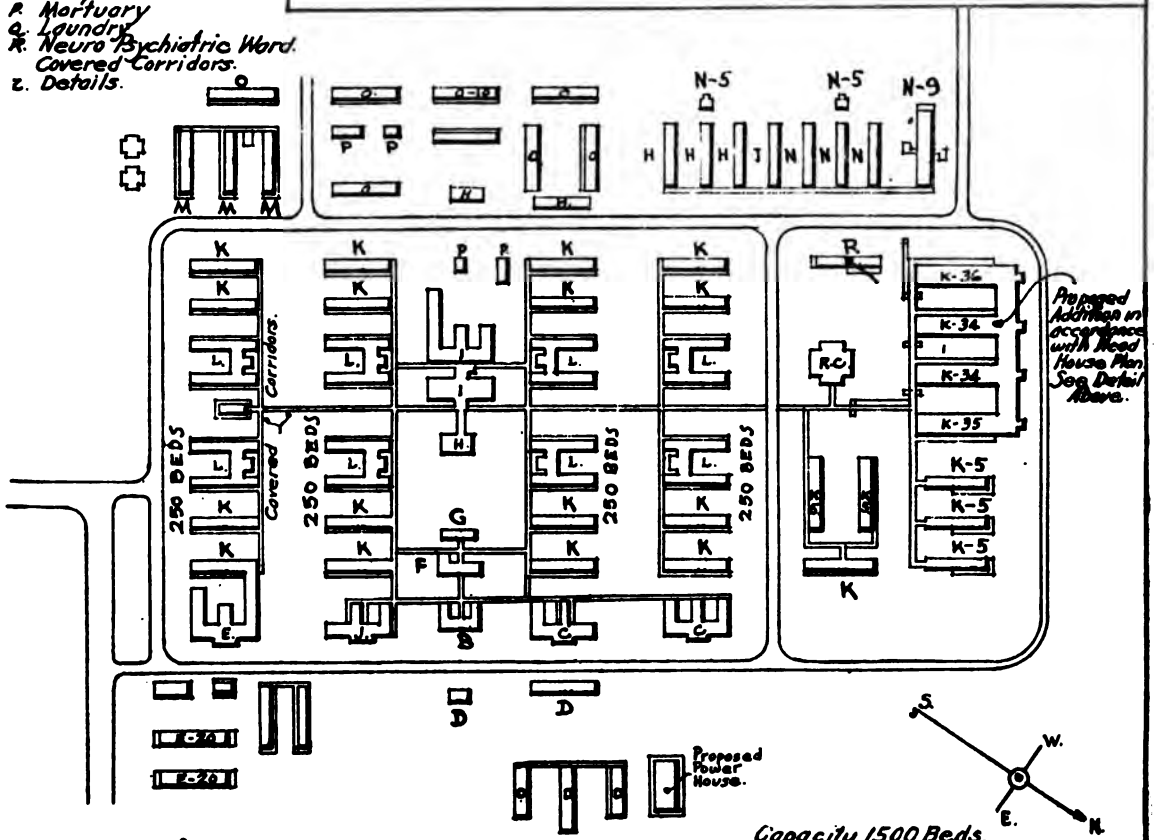
ELEVATION OF TWO STORY WARDS.
Sketch.

KEY TO LAYOUT.

- B Administration
- C Officers Ward.
- D " Quarters
- E Nurses " E-20
- F Laboratory
- G Operating Pav.
- H Garage
- I Shop
- J Mess & Kitchen
- K Receiving Ward.
- L Single Ward
- K-5 2 Story " K-34-35-36
- L. Ward & Lav.
- M. Isolation Ward.
- N Hosp. Corp. Det. Barracks
- N-9 Med. Dept. Personnel.
- N-5 Lavatories.
- O Store House
- O-18 Commissary Stores.
- P. Guard House
- P. Chapel
- R. Mortuary
- Q. Laundry
- R. Neuro Psychiatric Ward.
- Covered Corridors.
- Z. Details.



ROOF PLAN OF TWO STORY WARDS.



Scale.
0 50 100 200 300 400 500

GENERAL PLAN.

Capacity 1500 Beds.
N.G. Base Hospital

For original see Sheet 6132-207.

CONSTRUCTION DIVISION OF THE ARMY
BASE HOSPITAL: CAMP MacARTHUR
WACO, TEXAS.
CONSTRUCTED FOR THE SURGEON GENERAL OF THE ARMY

A

PAVILION TYPE PLOT PLAN

CONSTRUCTION DIVISION OF THE ARMY
COLONIA GENERAL HOSPITAL NO. 3
RAHWAY, N. J.
CONSTRUCTED FOR THE SURGEON GENERAL OF THE ARMY

A

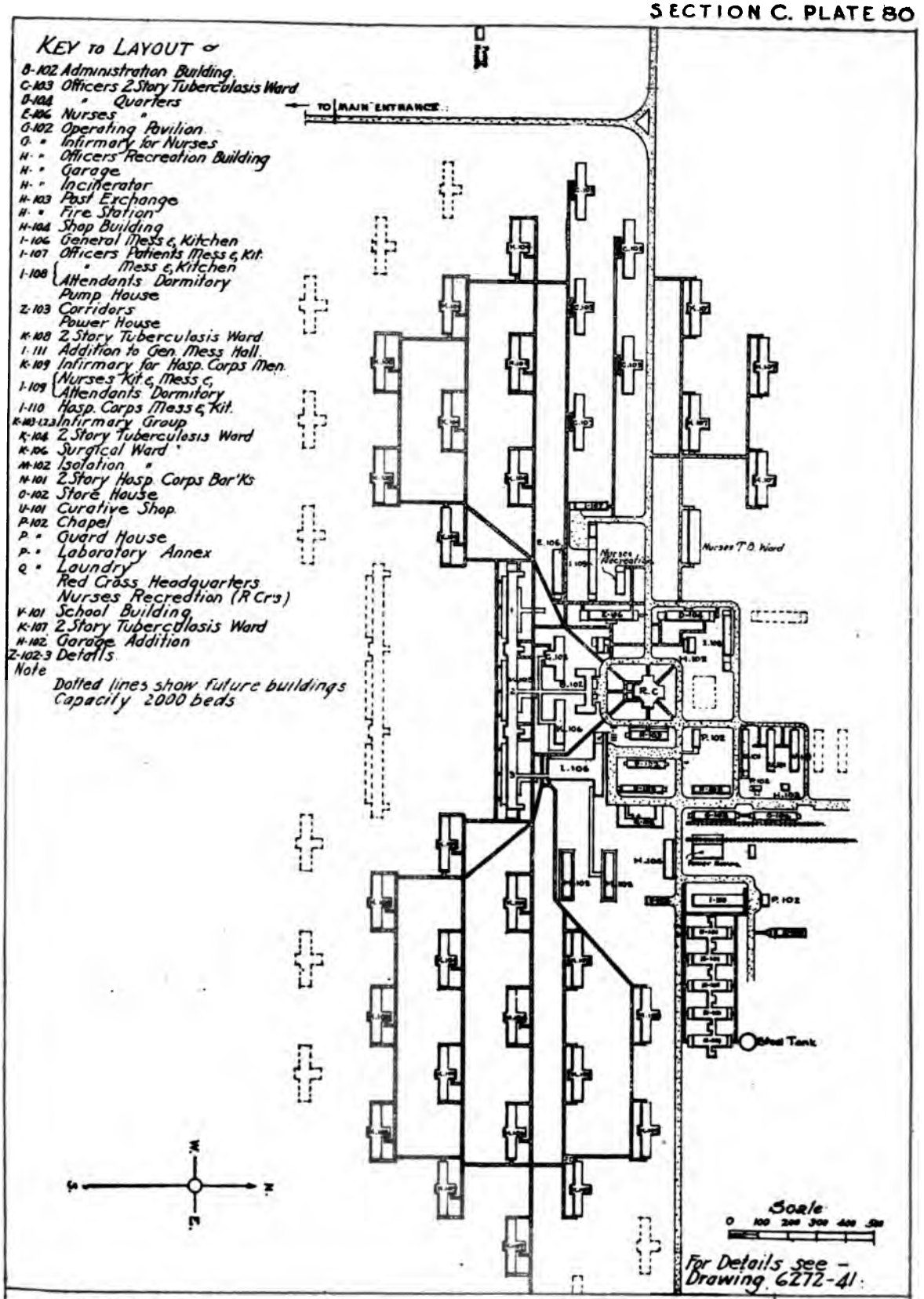
PLOT PLAN
PAVILION TYPE

For original see Drawing 6194-50.

CONSTRUCTION DIVISION OF THE ARMY
DEBARKATION HOSPITAL No 2
STATEN ISLAND, N.Y.
CONSTRUCTED FOR THE SURGEON GENERAL OF THE ARMY.

A

PLOT PLAN
PAVILION TYPE



CONSTRUCTION DIVISION OF THE ARMY

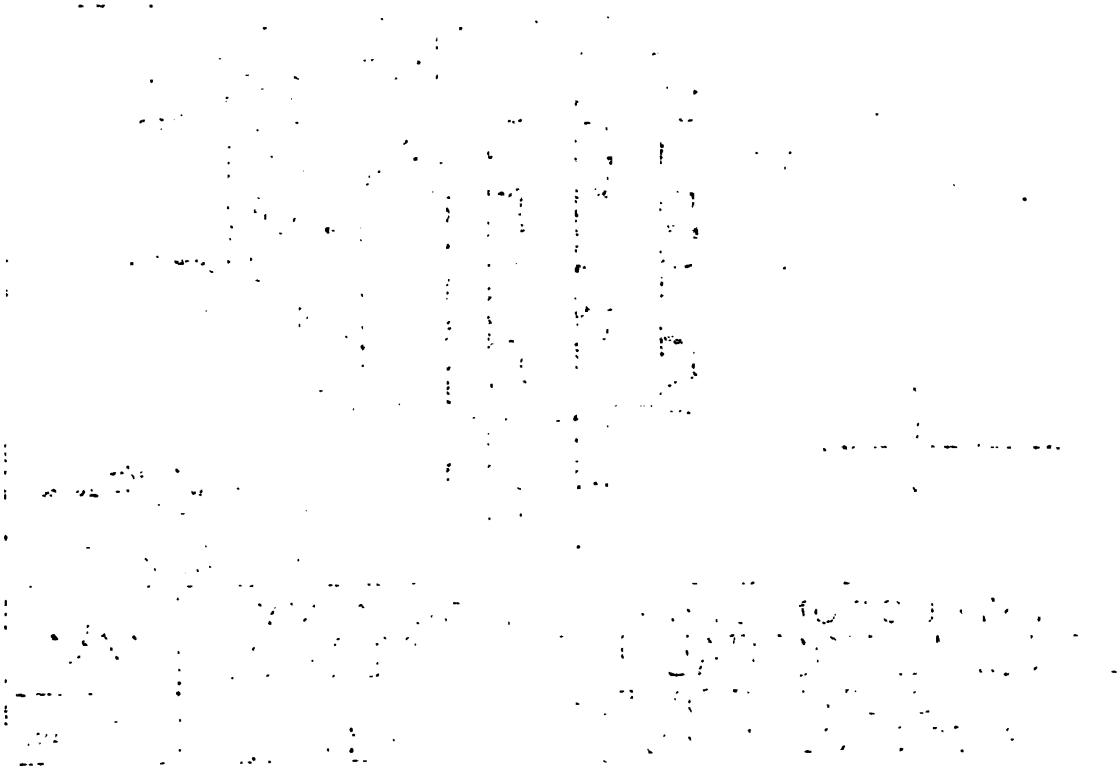
GENERAL HOSPITAL Nº21 DENVER COL.

CONSTRUCTED FOR THE

SURGEON GENERAL OF THE ARMY

·A·

SPECIAL PLOT· PLAN.



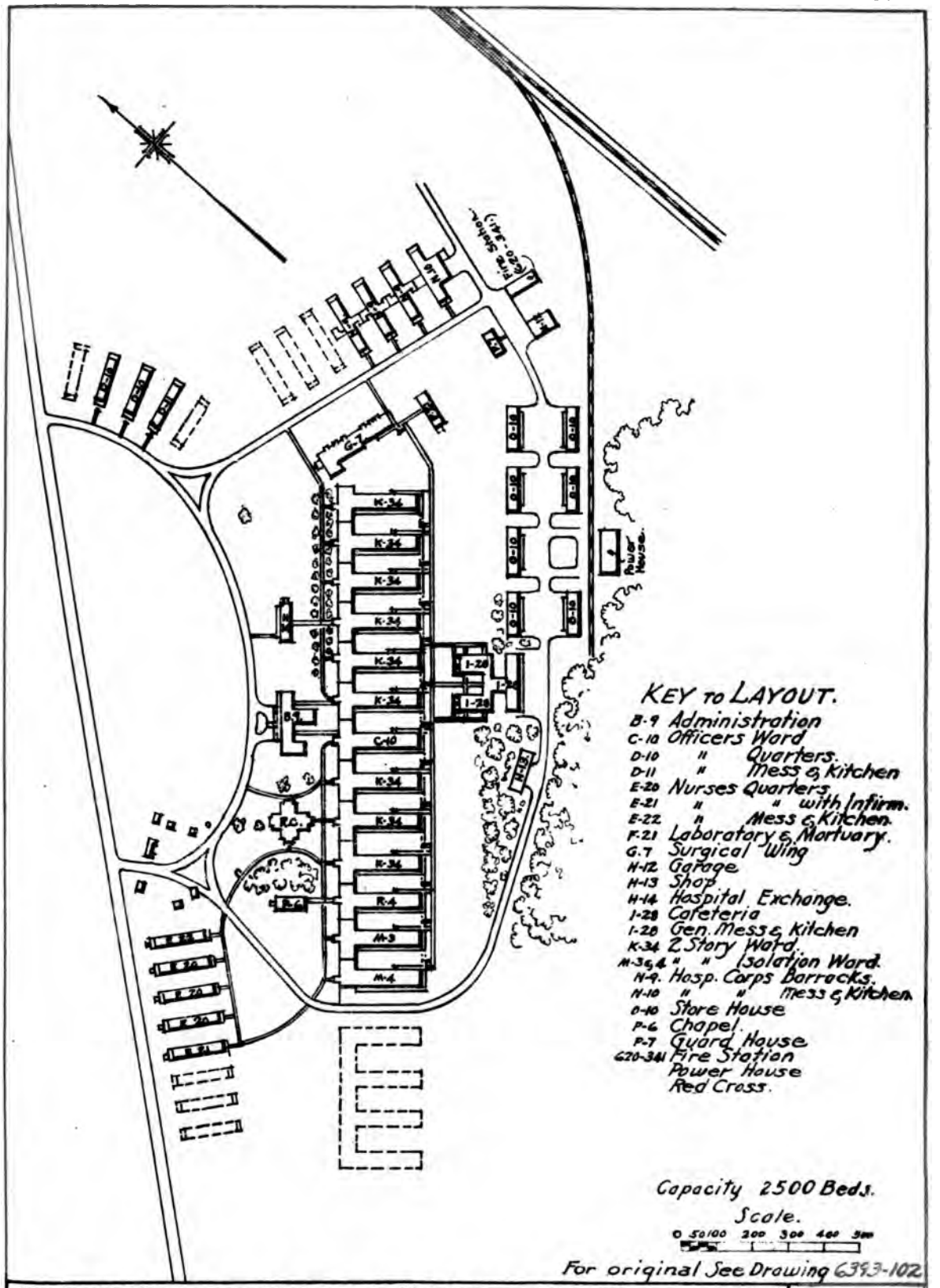
"KEY TO LAYOUT."

B-9. Admins. & Rec. Buildings.
C-10 { 1st Floor Ward / 2nd " Officers Ward
D-10 Officers Quarters
D-11 { Off. Quart. Mess & Kitchen / Attendants Dormitory
E-10 Nurses Quarters
E-21 " " with Infirmary
E-22 " " Mess & Kitchen
F-21 Laboratory & Mortuary
G-7 Operating Wing
H-12 Garage
H-13 Shop
H-14 Hospital Exchange
I-28 General Mess, Cafe & Kitchen.
K-34 Wards
M-3 1st Fl. Prison Ward. 2nd Fl. Part. Isolation.
M-4 " " Isolat. " " Patients.
N-9 Hosp. Corps Barracks.
N-10 { 1st Fl. Hosp. Corps. Mess & Kitchen / 2nd " " Barracks.
O-10 Store House
O-10 Commissary Stores
P-6 Chapel
R-4 Psychiatric Ward
R-7 Prison Guard House
Power House
Fire Station

For original see Drawing C402-130.

CONSTRUCTION DIVISION OF THE ARMY
SCHEMATIC LAYOUT-HEAD HOUSE TYPE
CONSTRUCTED FOR THE SURGEON GENERAL OF THE ARMY

A



KEY to LAYOUT.

B-9 Administration
C-10 Officers Ward
D-10 " Quarters.
D-11 " Mess & Kitchen
E-20 Nurses Quarters.
E-21 " " with Infirm.
E-22 " Mess & Kitchen.
F-21 Laboratory & Mortuary.
G-7 Surgical Wing
H-12 Garage
H-13 Shop
H-14 Hospital Exchange.
I-28 Cafeteria
I-28 Gen. Mess & Kitchen
K-34 2 Story Ward.
M-3&4 " " Isolation Ward.
N-9 Hosp. Corps Barracks.
N-10 " " Mess & Kitchen
O-10 Store House
P-6 Chapel.
P-7 Guard House.
G20-341 Fire Station
Power House
Red Cross.

Capacity 2500 Beds.

Scale.

0 50 100 200 300 400 500

For original See Drawing 6393-102

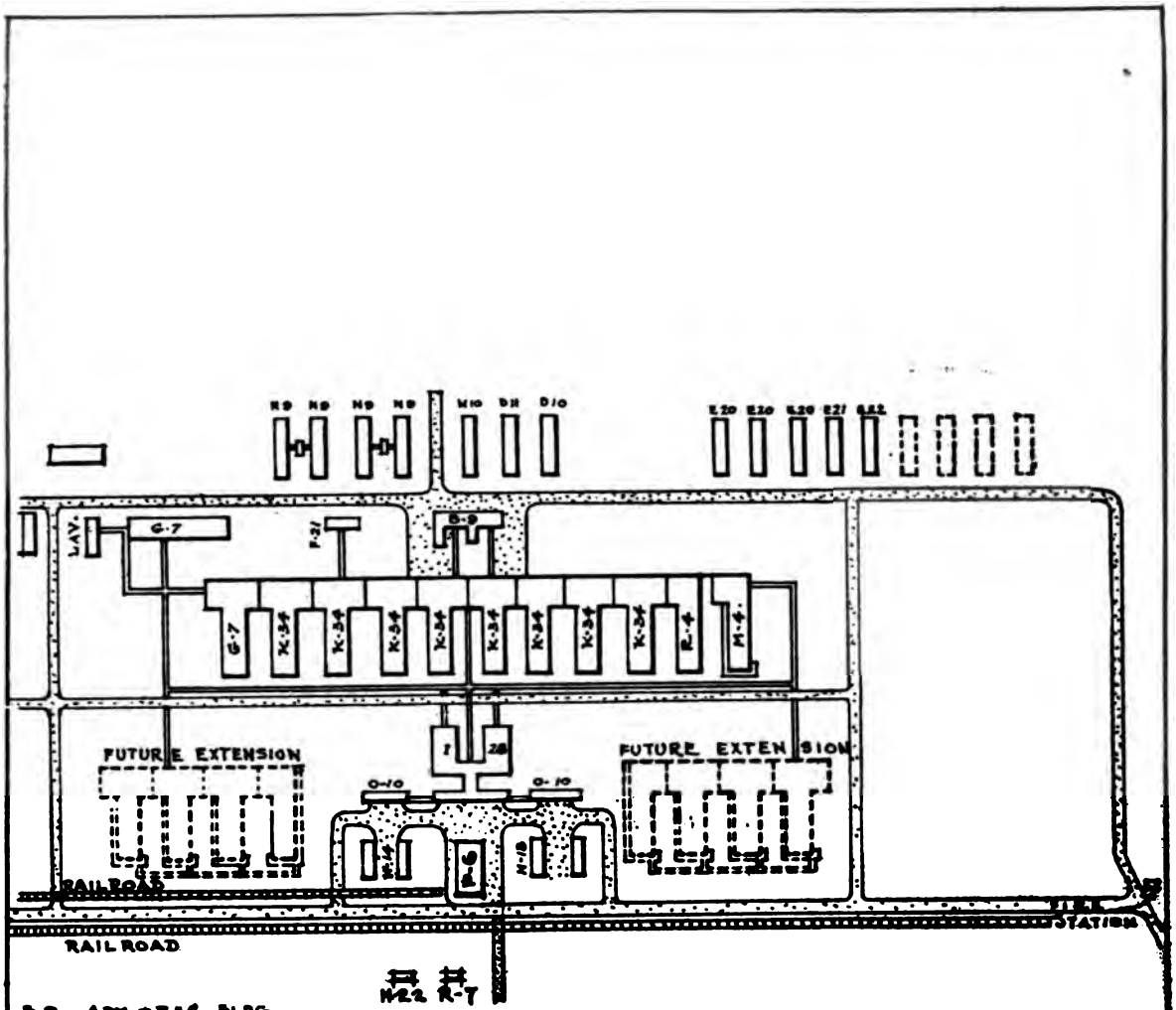
CONSTRUCTION DIVISION OF THE ARMY
BASE HOSPITAL-CAMP KNOX, KY.

CONSTRUCTED FOR THE SURGEON GENERAL OF THE ARMY

A

HEAD HOUSE TYPE

PLOT PLAN



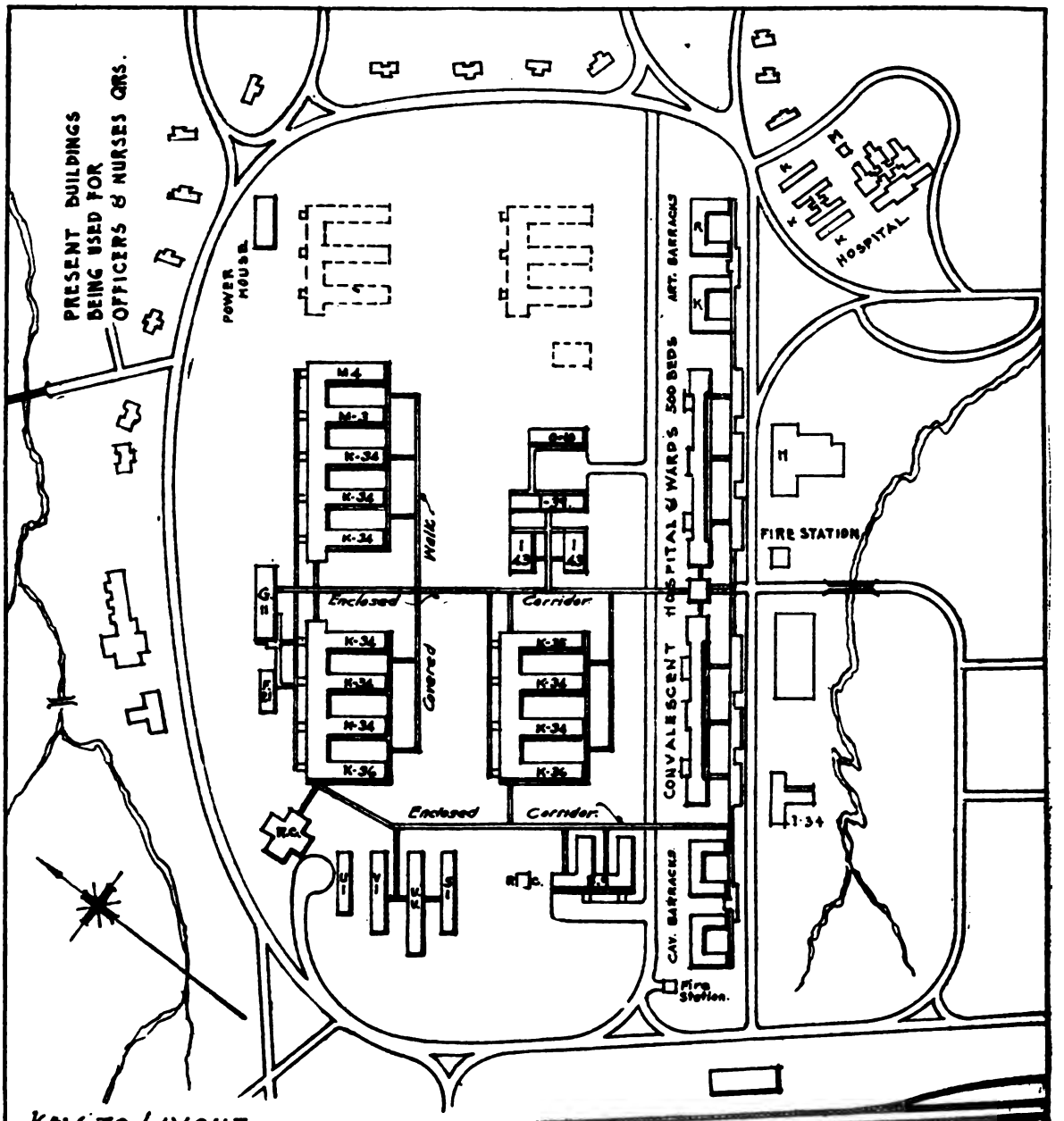
D-9. ADM. + REC. BLDG.
D-10 OFFICERS QUARTERS.
D-11 OFFICERS MESS + KITCHEN.
E-20 NURSES QUARTERS.
E-21 " " + INF.
E-22 " " MESS + KITCHEN.
P-21 LABORATORY + MORTUARY.
M-22 GARAGE.
M-13 SHOP BUILDING.
M-14 HOSP. EXCHANGE.
I-28 GEN. MESS + KITCHEN.
N-9 MED. CORPS DET. BARRACKS.
N-10. " " " WITH MESS + KIT.
O-10 STORE HOUSES.
P-6 CHAPEL.
P-7 GUARD HOUSE.
TWO STORY HOUSES.
M-4 ISOLATION WARDS.
R-4 PSYCHIATIC "
K-34 INTERMEDIATE "
K-34 2 STORY WING { 1ST. FL. WARD.
C-10 { 2ND. FL. OFFICER'S.
G-7 2 STORY CORNER WING (SURG.)
K-6 UMBERELLA + INCLOSED CORRIDORS.
FIRE STATION.
Z-1 CONSTRUCTION DETAILS.

SCALE.
0 50 100 200 300 400.

CONSTRUCTION DIVISION OF THE ARMY
BASE HOSPITAL CAMP MILLS N.Y.
CONSTRUCTED FOR THE SURGEON GENERAL OF THE ARMY

A

DEBARKATION PLOT. PLAN



KEY TO LAYOUT

B-9 Administration & Records
F-21 Laboratory & Mortuary
C-11 Surgical wing
I-39 & 43 Kitchen & mess
I-34 " " "
I-34, 35 & 36
M { 1st floor prison ward / 2nd " patients isolation
O-10 Commissary store house
S-1 Phys. Therapy
U-1 curative shops
V-1 school buildings
U-V school & curative shop
Z Const. details
Enclosed corridors
Covered walks
620.-341 Fire station

CAPACITY 3000 BEDS

DOTTED LINES SHOW FUTURE BUILDINGS

Scale
0 100 200 300 400

For Original See Drawing C407-103

CONSTRUCTION DIVISION OF THE ARMY
DEPARTMENTAL HOSPITAL LAYOUT
FORT SHERIDAN, ILL.
CONSTRUCTED FOR THE SURGEON GENERAL OF THE ARMY

A

PLOT PLAN: ALTERATION HEAD HOUSE TYPE

TYPICAL HOSPITAL BUILDINGS
DESCRIPTION AND REFERENCE DRAWINGS
PAVILION TYPE

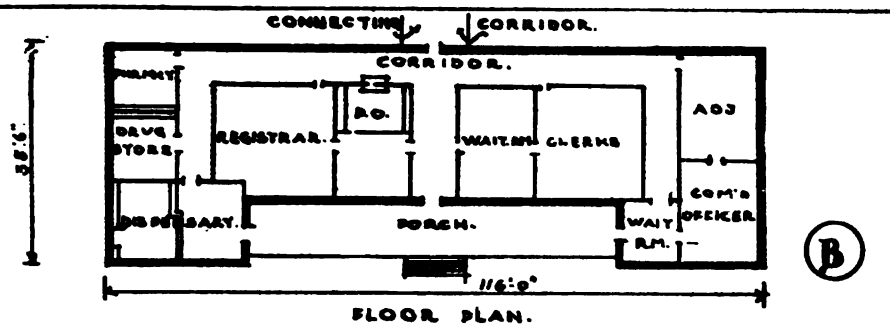
NOTE — BUILDINGS OF THIS TYPE ARE OF WOOD

S.G.O. SYMBOL	BUILDING	SIZE	STORY	DESCRIPTION	CONST DETAILS	ELECTRIC 632	PLUMBING 632	STEAM HEAT 632	STEAM	V. VACUUM G. GRAVITY
B	ADMINISTRATION	33-6 x 116	1	OFFICES, ETC.	Z-1	254	254		V	254 G
C	OFFICERS WARD	81-6 x 150-6	1	ROOMS, TOILET, MESS & KITCHEN	"	227	227	537		226 "
D-D[4]	" QUARTERS	24' x 150' 24' x 35'-6"	2	CAP. 22 ROOMS 2 TOILETS	"	157	157	537	237 "	
E	NURSES QUARTERS	81-6 x 157'	1	CAP. 24 ROOMS. 2 TOILETS MESS AND KITCHEN	"	282	282	537		281 "
F	LABORATORY	24' x 104'-6"	1	EYE, EAR, THROAT, DENTAL & X RAY	"	266	266			265 "
C	OPERATING PAVILION	24' x 93'	1	PUS DRESSING ROOM AND CLEAN OPERATING ROOM, ETC	"	291	291			290 "
H	POST EXCHANGE	24' x 84'	1	STORE ROOM, BARBER SHOP BILLIARDS & LAVATORY	"	203	203			203 "
H	GARAGE & SHOP	24' x 36' 24' x 130'	1	6 AMBULANCES, CARPENTER, ETC	"				SHOP 214 "	
I	MESS & KITCHEN	24' x 150'	1	CAP. 280 MEN OR 10 PER SEATING	"		272		271 "	
I[28]	GENERAL MESS & KITN	108' x 120'	1	CAPACITY 300 SEATINGS	"	1-28	663			714 "
J	RECEIVING WARD	81-6 x 150-6	1	RECEIVING & DISCHARGING, DRESSING ROOM OBSERVATION, STORAGE, ETC.	"	221	221	584	220 "	
K	SINGLE WARDS	24' x 150-6	1	CAP. 32 BEDS. TOILETS OFFICE DIET KITCHEN	"	190	190			189 "
L	WARD & LABORATORY	24' x 157'	1	CAP. 36 BEDS. TOILET, OFFICE, ETC.	"	298	298		297 "	
M	ISOLATION WARDS	24' x 150-6	1	CAPACITY 32 BEDS. OFFICE, ETC	"		192	584		450 "
N & N[2]	HOSPITAL CORPS BARRACKS & LAVATORY	24' x 156' 24' x 30'	2	CAPACITY 42 BEDS 4 ROOMS, ETC	"	225	151	537		224 "
O	STORE HOUSE	24' x 150'	1	2 OFFICES SHELVING ETC.	"	211			210 " 436 "	
P	CHAPEL	24' x 58-6	1	CAPACITY 200 SEATINGS	"		201		310 "	
P	GUARD HOUSE	24' x 36'	1	OFFICE GUARD RM. PRISONERS RM	"	322	322		322 "	
P	MORTUARY	24' x 35'-6"	1	VIEWING RM. MORTUARY & POST MORTEM	"		218		381 "	
Q	LAUNDRY	24' x 150-6	1	FOR EQUIPMENT SEE DRWG. Q[5]	"		310			
R	PHYCHIATRIC WARD	24' x 162'	1	CAP. 10 BEDS. TOILET, EXAM ROOM, - ROOMS, ETC	"	194	194			193 "
	FIRE STATION	31' x 87-10	1	APPARATUS 620-365	620 SERIES					
	BOILER HOUSE	43' x 45'-6"	1	BOILER RM, PUMPS, FUEL 412-2-						
	RED CROSS	100' x 100'	1	OFFICES, ASSEMBLY RM, SOLARIUM, ETC						

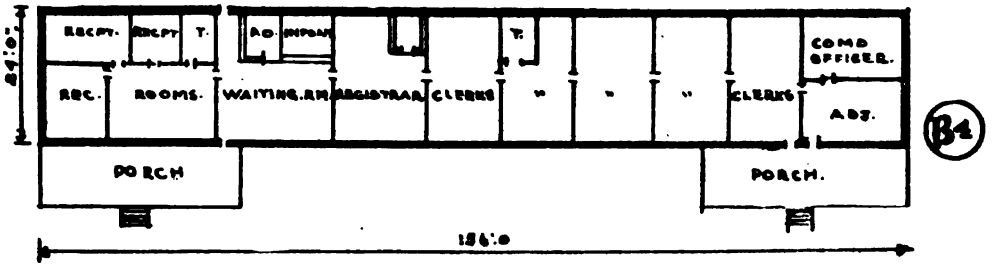
HEADHOUSE TYPE

NOTE — BUILDINGS OF THIS TYPE ARE WOOD, FRAME & STUCCO. FOR TILE BUILDINGS, SEE DENVER 62TE-41

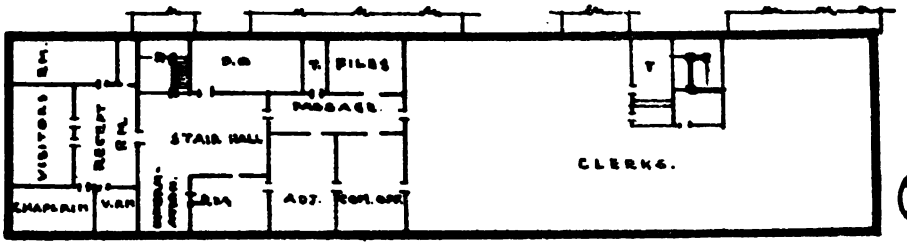
B-9	2 STORY ADMINISTRATION	96' x 156'	2	OFFICES	Z-1 3rd	B-9	654			701 G
C-10	" " OFFICERS WARD	48' x 222'	2	CAPACITY 69 BEDS. H. HOUSE AND QUIET ROOMS	"	C-10	653			702 "
D-10	" " " QUARTERS	50' x 56'	2	CAPACITY 49 OFFICERS 2 STAFF OFFICERS with LIVING RM. LAV. ETC.	"	D-10	662			705 "
D-11	" " " QTS. MESS & KITN	50' x 156'	2	CAPACITY 100	"	D-11	661			704 "
E-10	" " NURSES QUARTERS	30' x 156'	2	CAPACITY 51 BEDS	"	E-20	660	582		705 "
E-21	" " " QTRS & INFIR, 2ND PL	30' x 156'	2	CAPACITY 40 BEDS	"	E-21	656	582		706 "
E-22	" " " " MESS & KITN	30' x 156'	2	CAPACITY 250	"	E-22	659			707 "
F-21	" " LAB. & MORTUARY	32' x 108'	2	FOR EQUIPMENT, SEE DRAWINGS.	"	F-21	658			708 "
G-7	" " SURGICAL WING [2 PLS]	48' x 222'	2	1ST FL. PUS DRESSING RM & CLEAN OPRTG. RM 2ND EYE, EAR, NOSE X RAY & DENTAL DEPT.	"	G-7	655			709-710 "
H-12	1 STORY GARAGE	48' x 48'	1	CAP. 8 MACHINES; WASHING ROOM	"	H-12				711 "
H-13	" " SHOP BUILDING	32' x 108'	1	SHOP TAILOR, COBBLER, CARPENTER, BLACKSMITH, MATTRESS REPAIR, ETC	"	H-13				712 "
H-14	2 " HOSPITAL EXCHANGE	24' x 84'	2	STORE BARBER SHOP ETC	"	H-14				713 "
I-28	1 " GENERAL MESS & KITN	60' x 108' 36' x 180'	1	CAP; CAFE 530 MEN; GENL. MESS 530 MEN	"	I-28	663			714 "
K-34	2 " WARDS [2 PLANS]	48' x 222'	2	CAP. WARD 100 BEDS. H HOUSE 10 BEDS LABORATORY & NURSES RETIRING RM	"	K-34	664	584		715-716 "
M-3	" " ISOLATION WARD [2 PL]	48' x 222'	2	CAP. 32 BEDS. H HOUSE 10 BEDS LAVATORY & NURSES ROOM	"	M-3	666			717-718 "
M-4	" " " " "	48' x 222'	2	CAP. WING 32 BEDS. H HOUSE 7 BEDS	"	M-4	665			719-720 "
N-9	" " HOS. CORPS BARRACKS	36' x 168'	2	CAPACITY 100 BEDS	"	N-9	667	584		721 "
N-10	HOS. CORPS DETACHMENT BARRACKS, MESS & KITCHEN	36' x 168'	2	CAP. 100 BEDS, CAFETERIA 625 SEATS	"	N-10				723 "
O-10	1 STORY STORE HOUSE	52' x 120'	1	OFFICE STORE RM. SHELVING	"	O-10				724 "
P-6	" " CHAPEL	34' x 54'	1	CAPACITY 350	"	P-6				725 "
P-7	" " GUARD HOUSE	24' x 60'	1	OFFICE, GUARD RM. PRISONERS RM	"	P-7				726 "
Q	" " LAUNDRY	24' x 150-6	1	FOR EQUIPMENT SEE DRWG. Q[5]	Z-1 3rd	Q	310			
R-4	2 " PSYCHIATRIC WARD	48' x 222'	2	CAP. WARD 36 BEDS H HOUSE 20 BEDS LABORATORY & NURSES ROOM	"	R-4	657			727-728 "
	" " POWER HOUSE	43' x 45-6	1	BOILER RM. PUMPS. FUEL 412-2						
	" " FIRE STATION	31' x 87-10	1	APPARATUS 620-341	620 SERIES					
	RED CROSS	100'-100'	1	OFFICES, ASSEMBLY RM SOLARIUM						



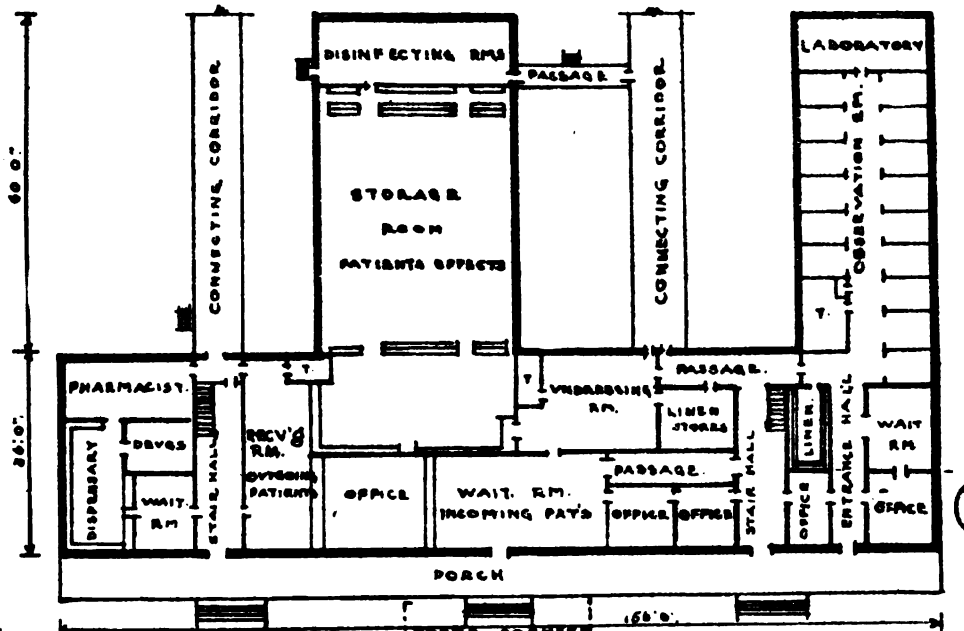
FLOOR PLAN.



FLOOR PLAN



SECOND FLOOR PLAN



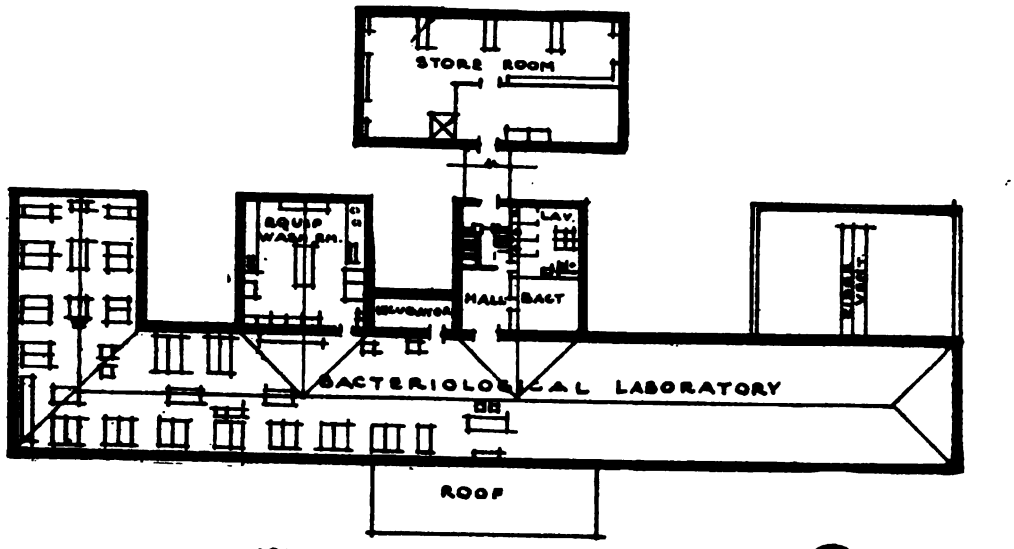
SCALE. 0 8 16 24 32 FIRST FLOOR PLAN

FOR ORIGINAL SEE DRWG. Z

CONSTRUCTION DIVISION OF THE ARMY
TYPICAL HOSPITAL BUILDINGS
CONSTRUCTED FOR THE SURGEON GENERAL OF THE ARMY

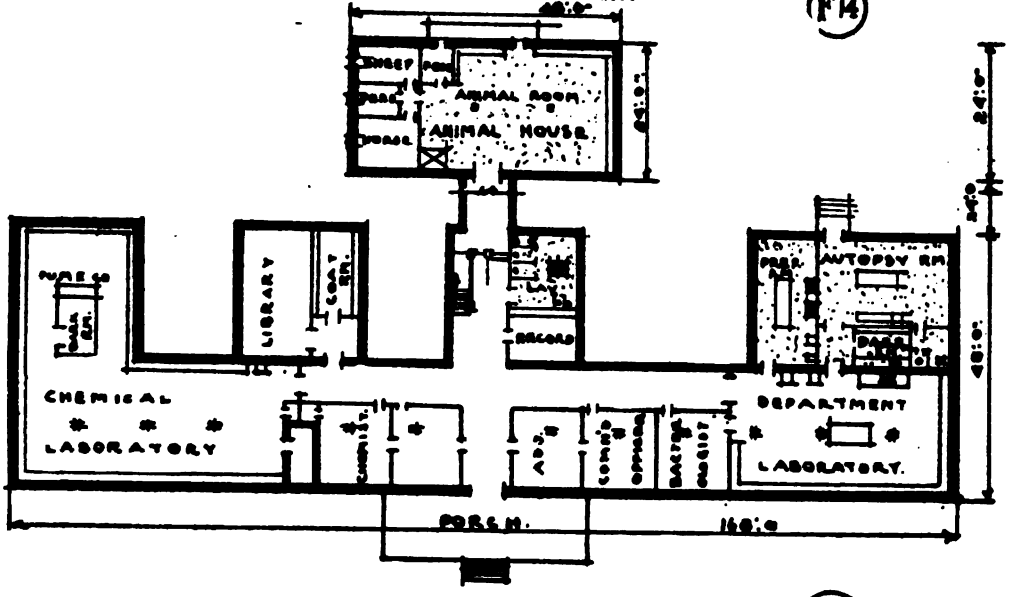
B

ADMINISTRATN



SECOND FLOOR PLAN

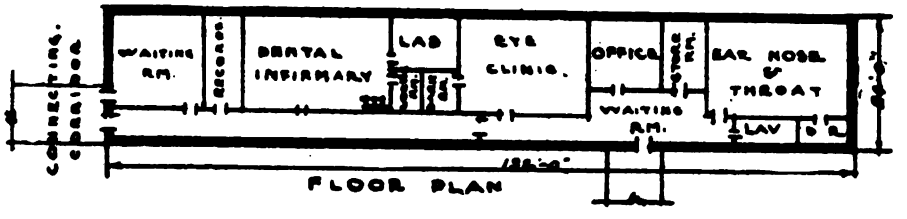
F14



FIRST FLOOR PLAN

DEPARTMENT LABORATORY

F14



FLOOR PLAN

EYE. EAR. NOSE & THROAT CLINIC

DENTAL INFIRMARY

F14

SCALE

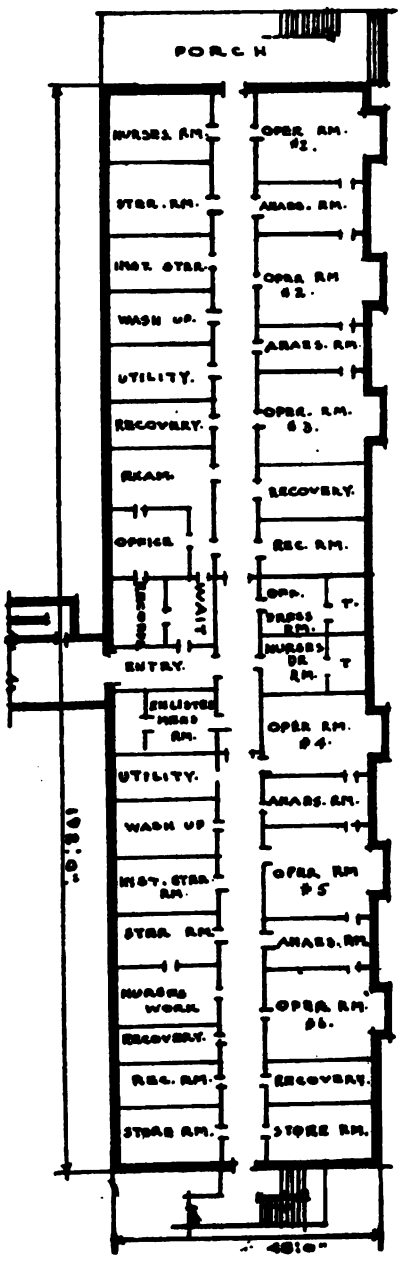
FOR ORIGINAL SEE DRWG. 2

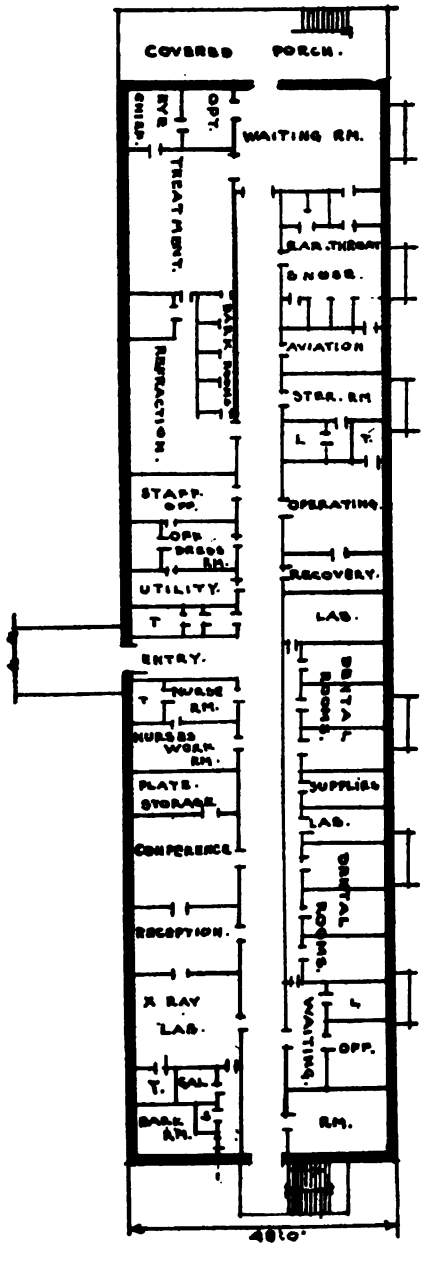
CONSTRUCTION DIVISION OF THE ARMY
TYPICAL HOSPITAL BUILDINGS

CONSTRUCTED FOR THE SURGEON GENERAL OF THE ARMY

F

LABORATORY





OPERATING PAVALION

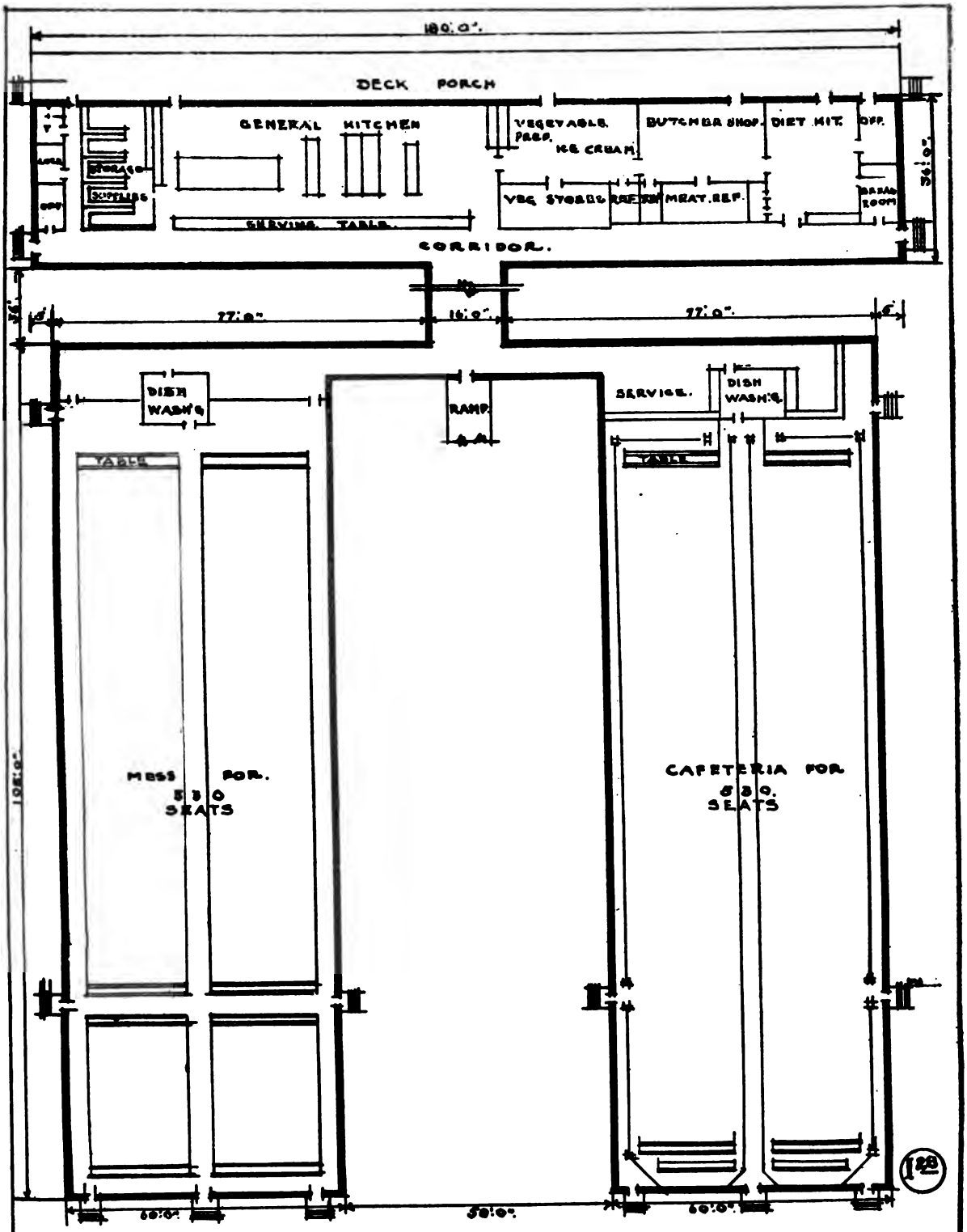
SCALE 0 8 16 24 32

FOR ORIGINAL SEE DRWG. Z

CONSTRUCTION DIVISION OF THE ARMY
TYPICAL HOSPITAL BUILDINGS
CONSTRUCTED FOR THE SURGEON GENERAL OF THE ARMY

G

OPERATING PAVALION



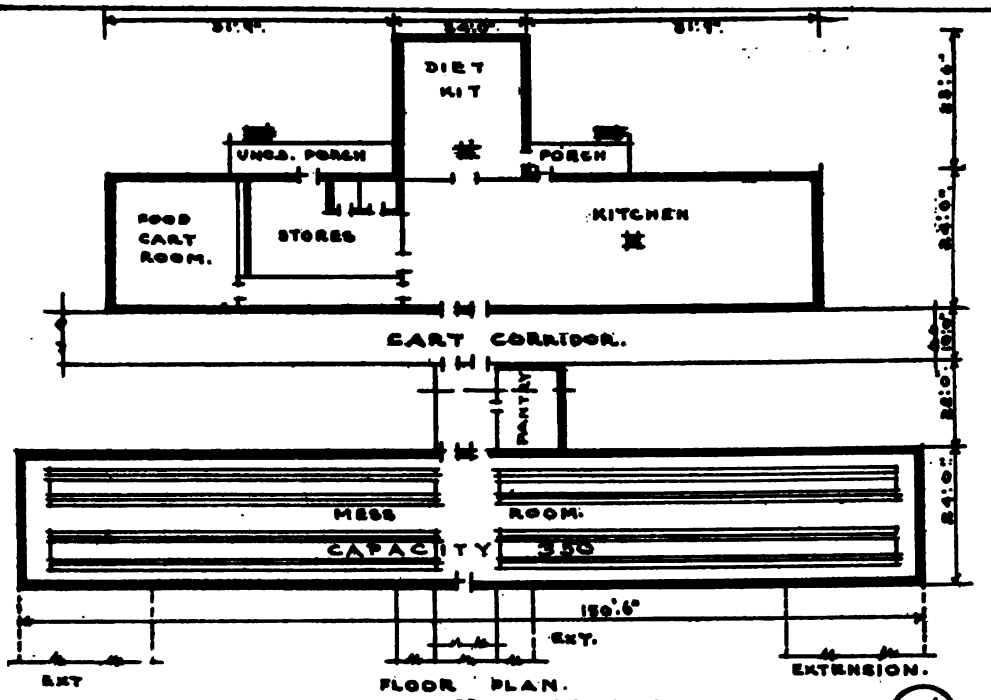
FLOOR PLAN.
GENERAL MESS & KITCHEN
FOR ORIGINAL SEE DRWG. Z

SCALE 0 8 16 24 32

CONSTRUCTION DIVISION OF THE ARMY
TYPICAL HOSPITAL BUILDINGS
CONSTRUCTED FOR THE SURGEON GENERAL OF THE ARMY

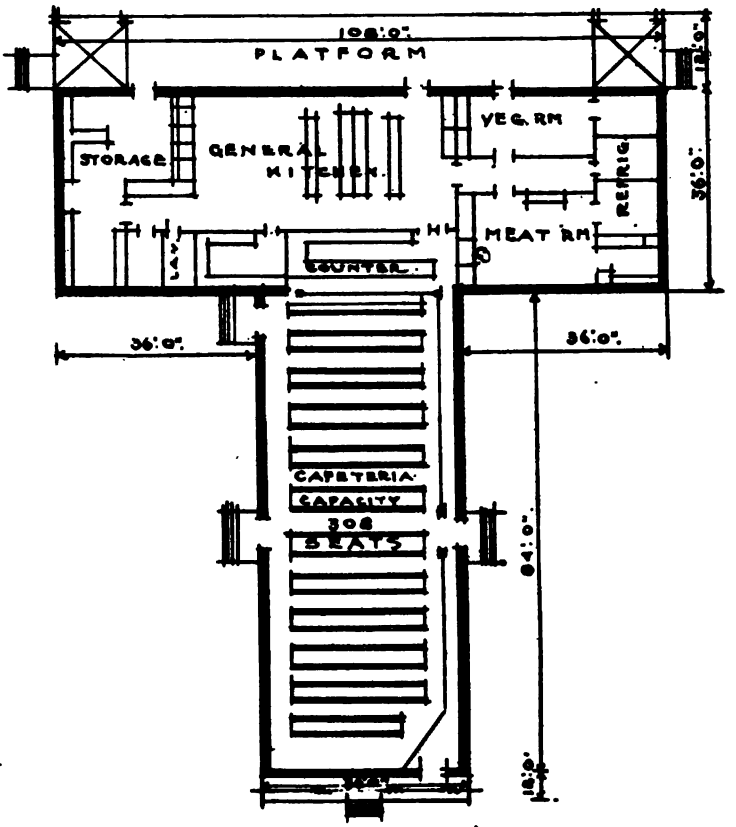
1

KITCHEN & MESS



FLOOR PLAN.
KITCHEN & MESS ROOM.

1 1/4



1 3/8

GENERAL MESS & KITCHEN
CAFETERIA SERVICE.

SCALE

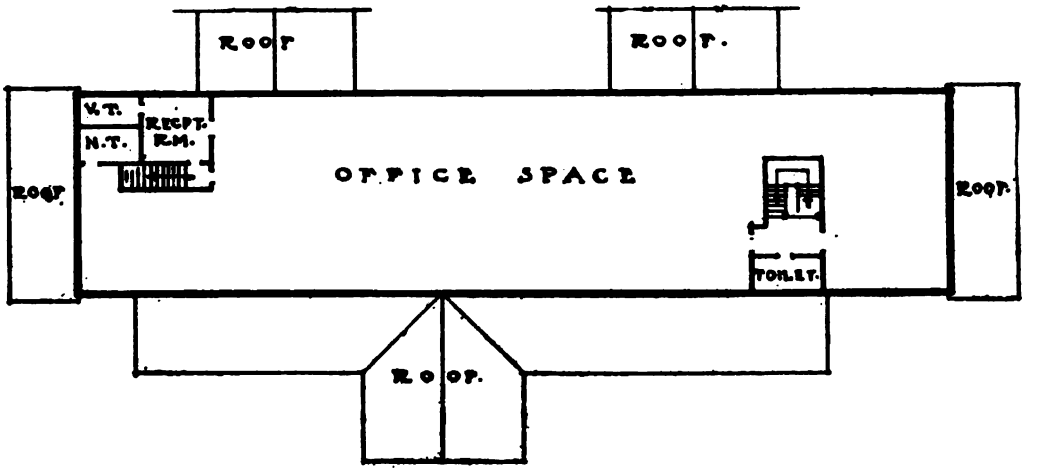
FOR ORIGINAL SEE DRWG. Z

CONSTRUCTION DIVISION OF THE ARMY
TYPICAL HOSPITAL BUILDINGS

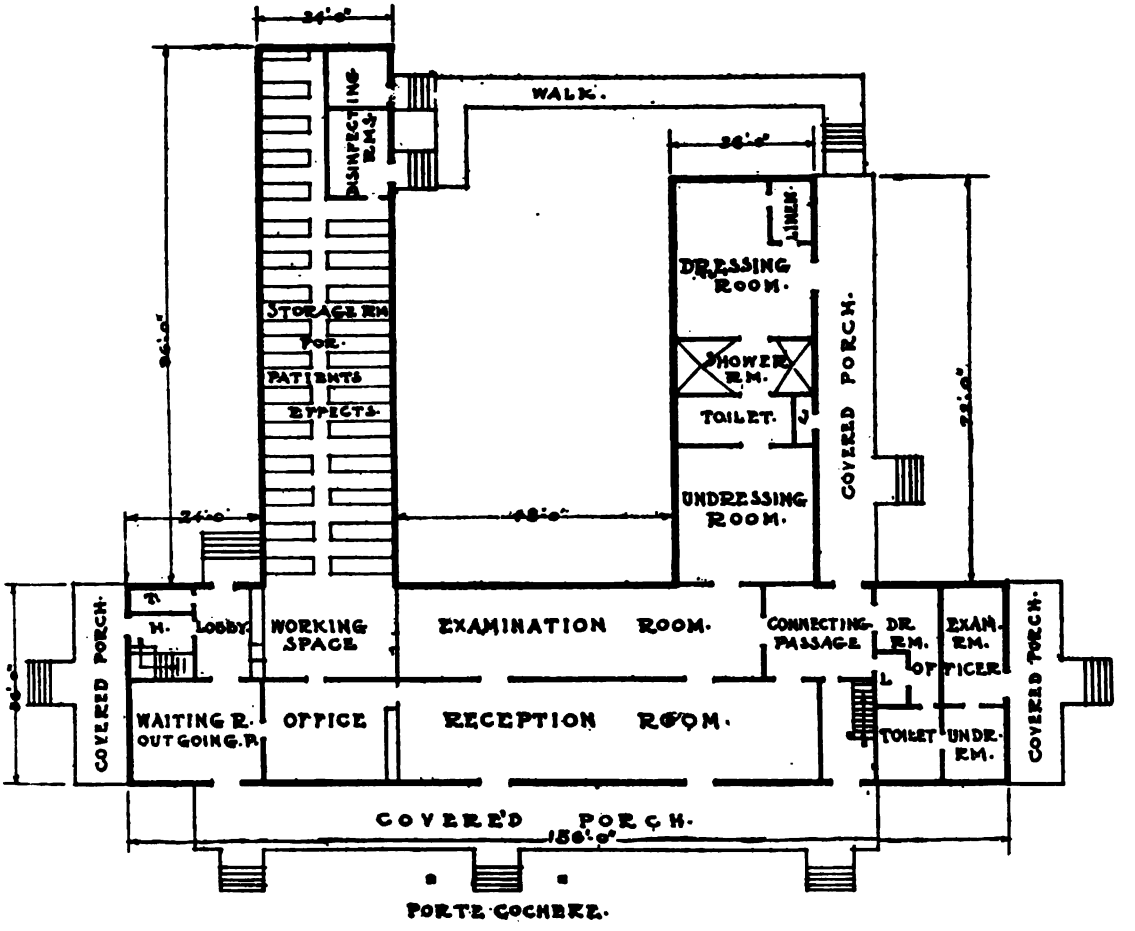
CONSTRUCTED FOR THE SURGEON GENERAL OF THE ARMY

1

KITCHEN & MESS



SECOND FLOOR PLAN.



FIRST FLOOR PLAN.

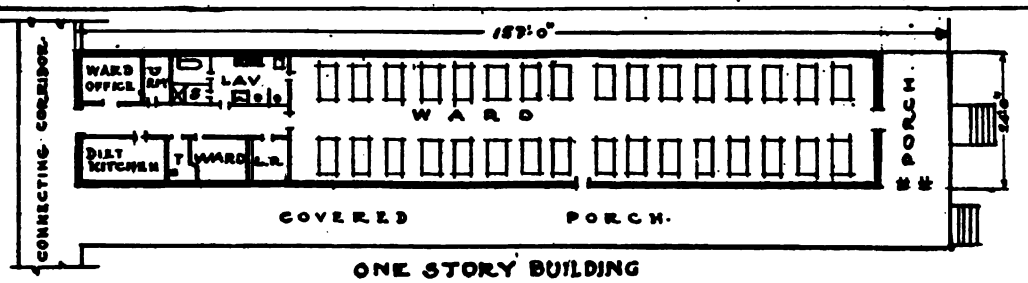
SCALE 0 8 16 24 32

FOR ORIGINAL SEE DRWG. Z

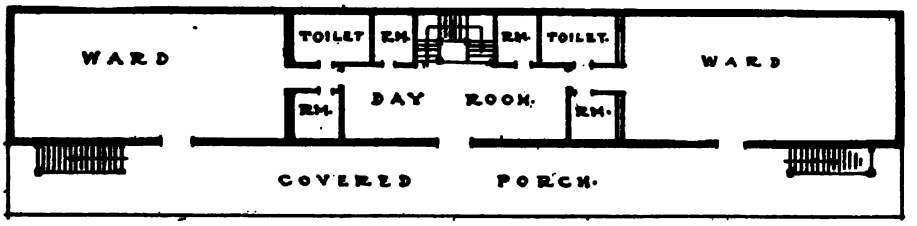
CONSTRUCTION DIVISION OF THE ARMY
TYPICAL HOSPITAL BUILDINGS
CONSTRUCTED FOR THE SURGEON GENERAL OF THE ARMY

J

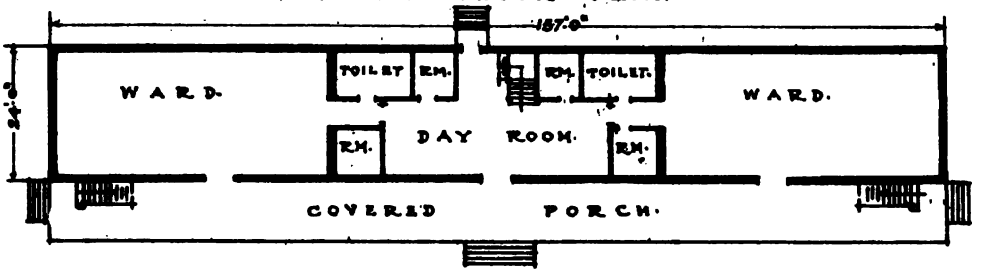
RECEIVING BLDG



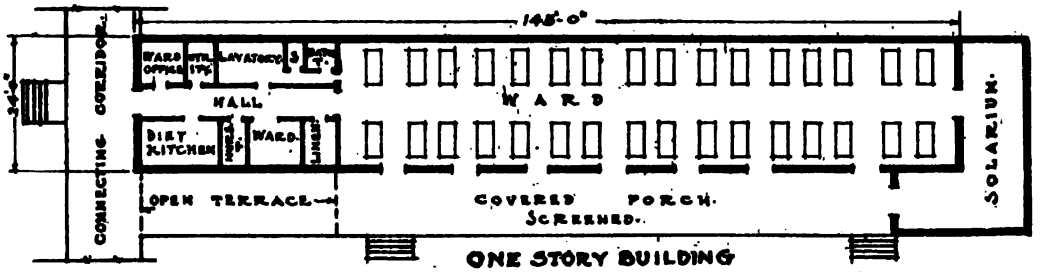
ONE STORY BUILDING
FLOOR PLAN. WARD AND LAVATORY. REVISED. K1



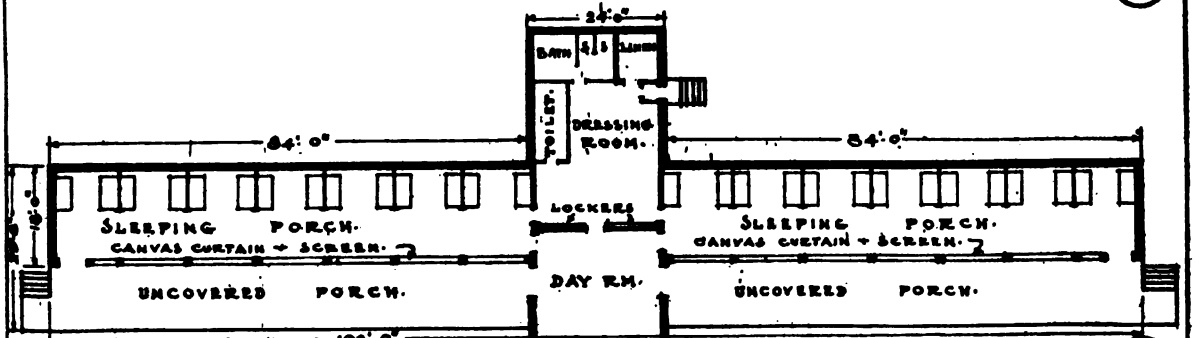
SECOND FLOOR PLAN.



FIRST FLOOR PLAN. WARD BARRACK. K5



ONE STORY BUILDING
FLOOR PLAN. TUBERCULOSIS WARD K9

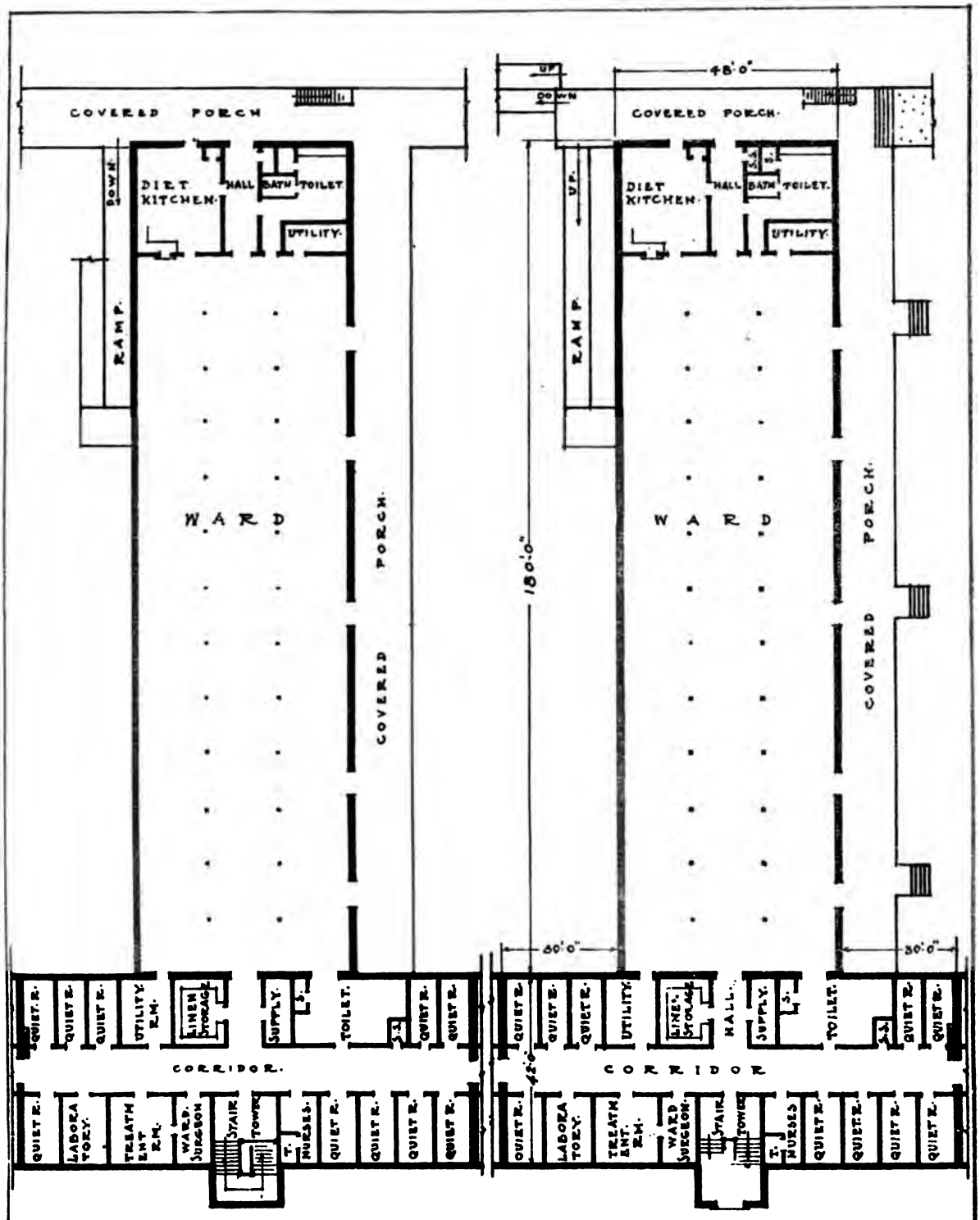


FLOOR PLAN TUBERCULOSIS WARD. K14
ONE STORY BUILDG.
SCALE 0 16 24 32
FOR ORIGINAL SEE DRWG. Z

CONSTRUCTION DIVISION OF THE ARMY
TYPICAL HOSPITAL BUILDINGS
CONSTRUCTED FOR THE SURGEON GENERAL OF THE ARMY

K

WARD.



SECOND FLOOR PLAN. FIRST FLOOR PLAN.

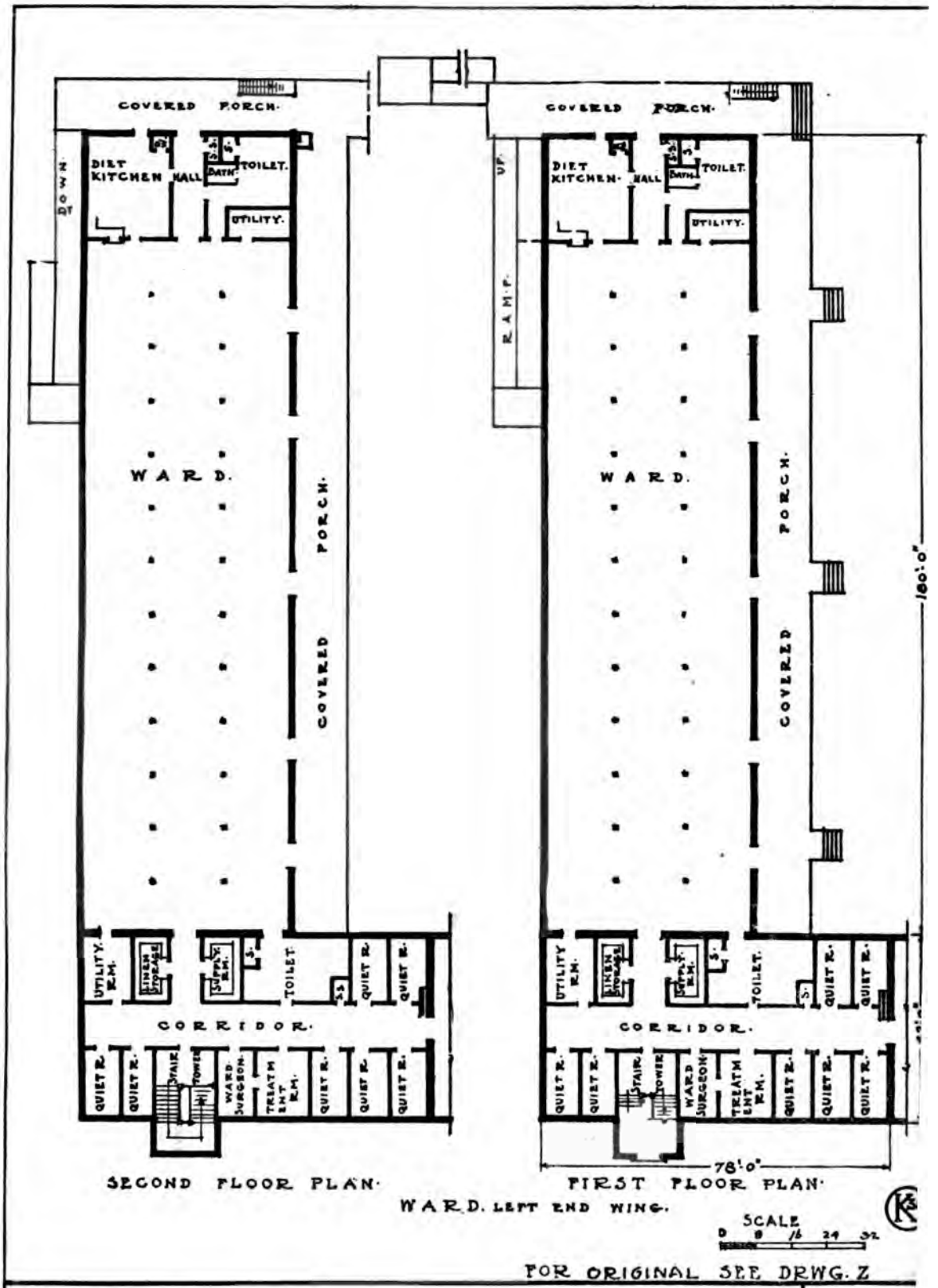
WARD - INTERMEDIATE WING.

SCALE 0 8 16 24 32

CONSTRUCTION DIVISION OF THE ARMY
TYPICAL HOSPITAL BUILDINGS
CONSTRUCTED FOR THE SURGEON GENERAL OF THE ARMY

K

HEAD HOUSE TYPE WARD



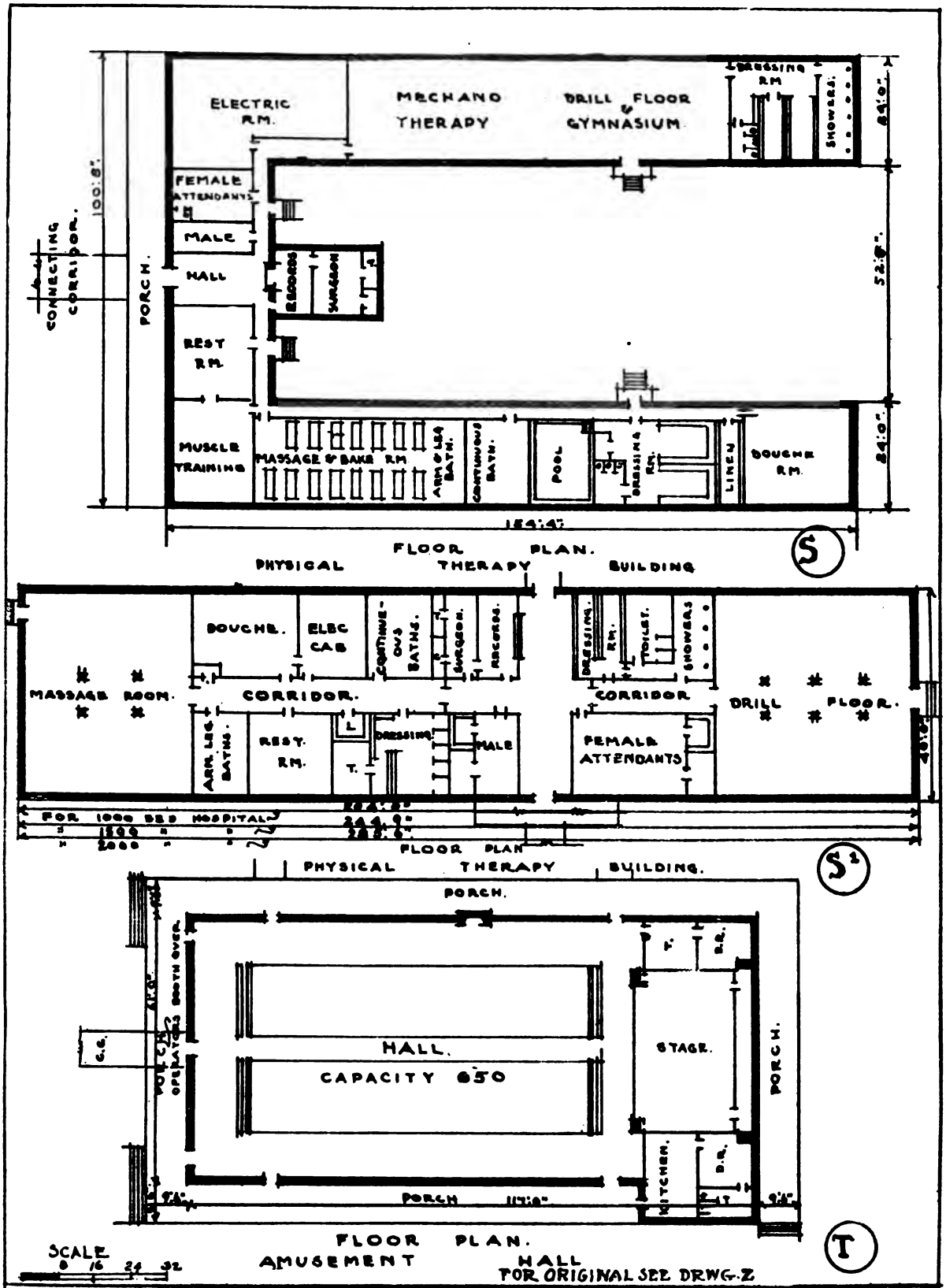
CONSTRUCTION DIVISION OF THE ARMY

TYPICAL HOSPITAL BUILDINGS

CONSTRUCTED FOR THE SURGEON GENERAL OF THE ARMY

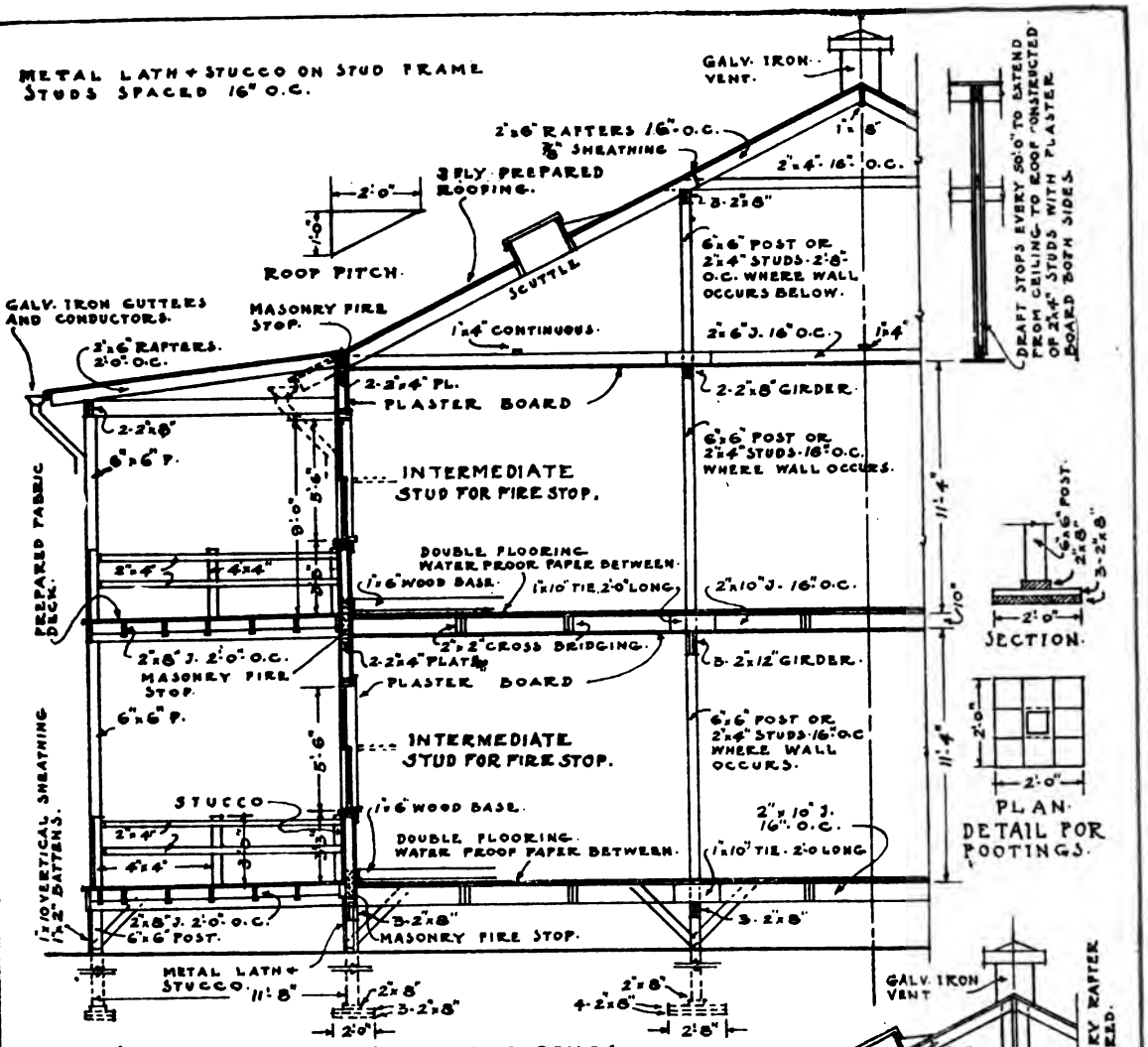
K

READ HOUS TYPE WARD.

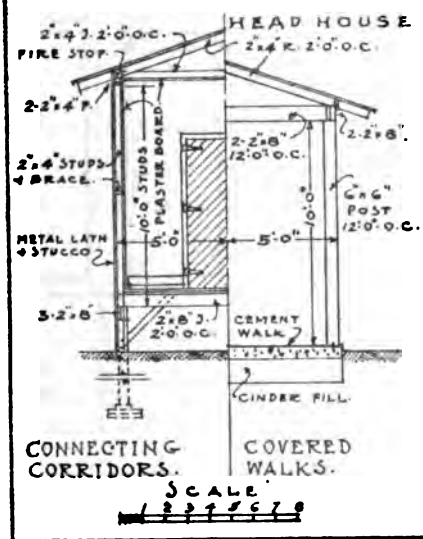


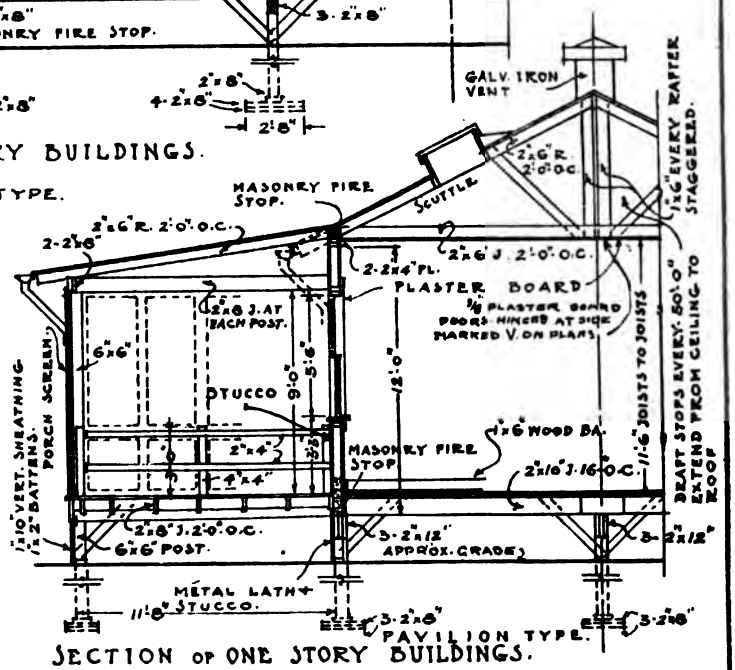
CONSTRUCTION DIVISION OF THE ARMY
TYPICAL HOSPITAL BUILDINGS
CONSTRUCTED FOR THE SURGEON GENERAL OF THE ARMY

S	T
PHYS. THERAPY	AMUSE. BLDG.



SECTION OF TWO STORY BUILDINGS.





SECTION OF ONE STORY BUILDINGS.

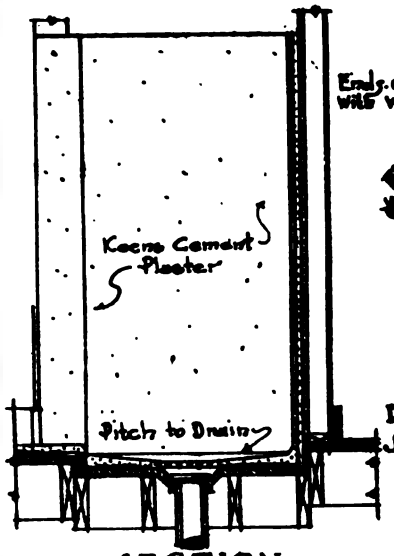
FOR ORIGINAL SEE DRWG. Z 1109

CONSTRUCTION DIVISION OF THE ARMY
TYPICAL HOSPITAL BUILDINGS

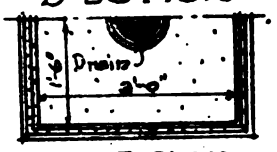
CONSTRUCTED FOR THE SURGEON GENERAL OF THE ARMY

Z

FRAME & STUCCO BLDG. DETAILS

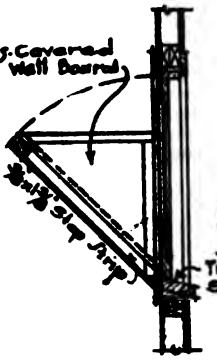


SECTION

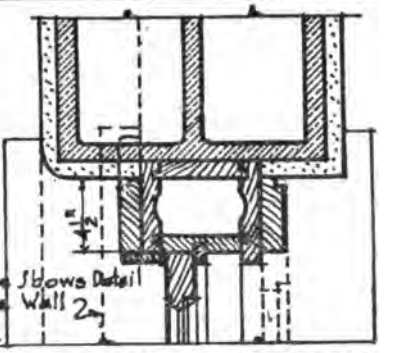


HALF PLAN

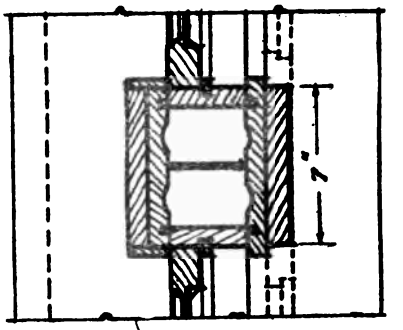
DETAIL OF TYPICAL SHOWER STALLS ALL TYPES.



DETAIL OF WIND SHIELDS SLEEPING PORCH WINDOWS T.B. WARDS.

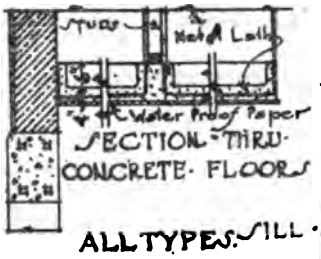


JAMB & HEAD SECTION



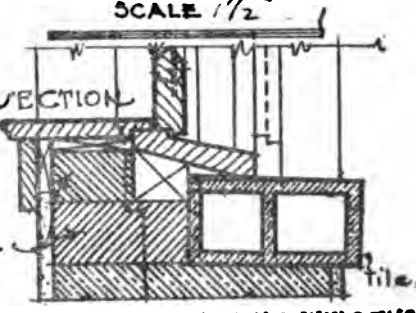
SECTION THRU MULLION

SCALE 1½"



SECTION THRU CONCRETE FLOORS

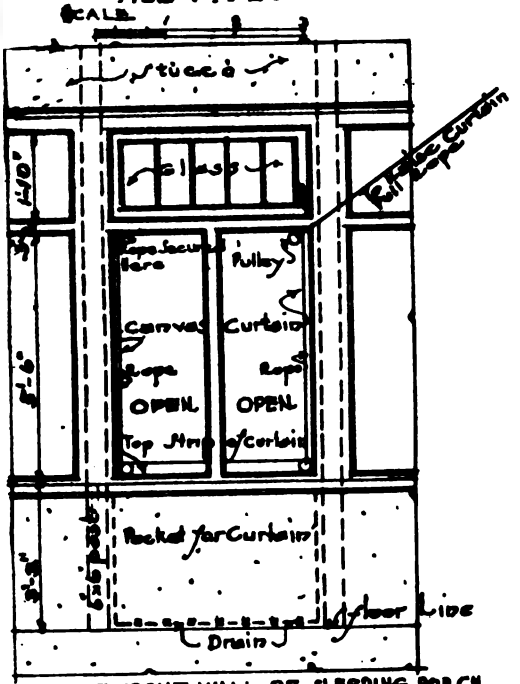
ALL TYPES.



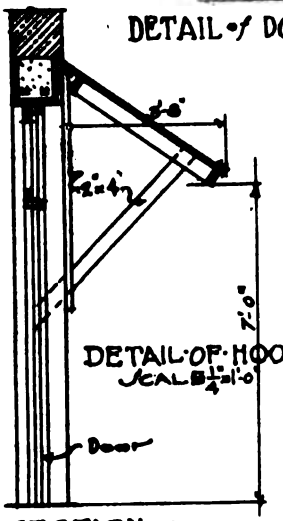
SILL SECTION

DETAIL of DOUBLE HUNG WINDOWS

Z-102



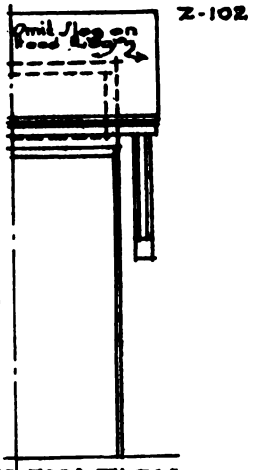
DETAIL OF FRONT WALL OF SLEEPING PORCH SHOWING CANVAS CURTAIL AND ITS OPERATION T.B. WARDS.



DETAIL OF HOODS

SCALE 1½"=1'-0"

SECTION ALL TYPES.



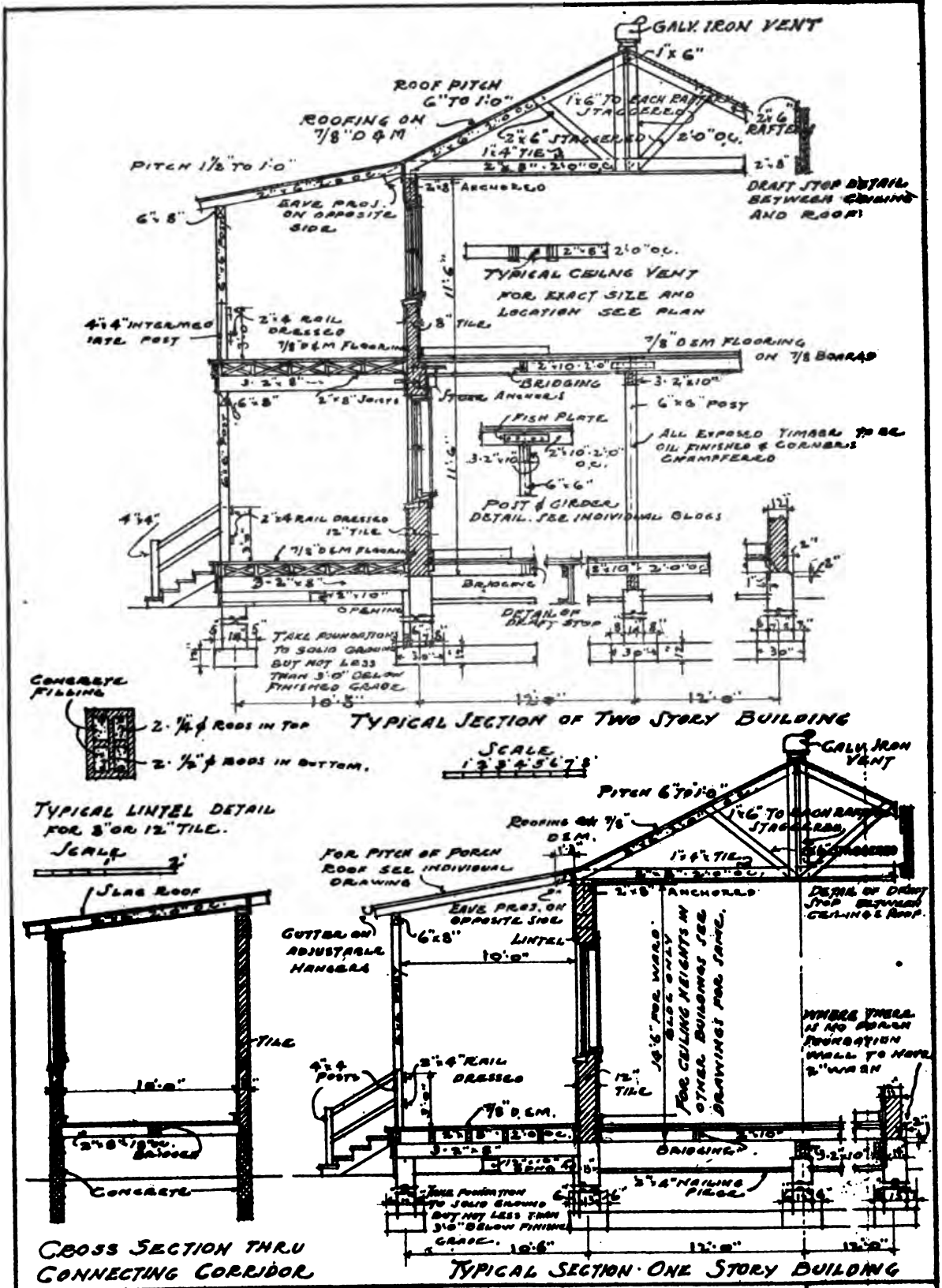
ELEVATION

SCALE

CONSTRUCTION DIVISION OF THE ARMY
TYPICAL HOSPITAL BUILDINGS
CONSTRUCTED FOR THE SURGEON GENERAL OF THE ARMY

Z

TILE BLDG. DETAILS



CONSTRUCTION DIVISION OF THE ARMY

TYPICAL HOSPITAL BUILDINGS

CONSTRUCTED FOR THE SURGEON GENERAL OF THE ARMY

Z101

TILE BLOCK DETAILS

RETRACED FROM ORIGINAL 3/23/19 · E.C.B.

GENERAL ARRANGEMENT.

The layout of the Military Hospital must first of all lend itself to efficient medical administration. As far as physical conditions permit, the Receiving Building should be placed close to the Administration Building. War Buildings should be located in economical relation both as to distance to be traversed to and from the receiving and service portions of the hospitals, as well as to the floor levels of the different buildings. Buildings for special purposes, such as Laboratories, Operating Buildings and Treatment Buildings should be located as centrally as possible.

Hospitals built of temporary wood construction require that every reasonable precaution be taken against fire. Buildings should be placed not less than fifty feet apart. Where there are a number of buildings in rows, fire-breaks consisting of cleared ground at least one hundred and fifty feet in width should be provided between rows. Because of the pockets created by the intersection of connecting corridors, great care must be taken that trails for fire apparatus lead into these pockets through the corridors, by means of ramps or cuts. In the corridors, themselves draft stops, with flush panel wooden doors held by fusible links, at intervals of one hundred and fifty feet should be provided. By consulting Plate No.'s 75 to 98 inclusive, relating to Hospitals, many of the standards used in Hospital Construction may be obtained. For description of materials and for methods of construction in general, see "Construction Notes," under heading of "Buildings."

The designs submitted by the office of the Surgeon General show, through changes, a steady development of the Pavilion Type of hospital into the Head House Type. By making buildings two stories and uniting them at one end by a continuous building connecting the wings, one-third of the ground area formerly occupied by the original base hospital design is used for this latter type. All utilities are concentrated, the buildings are better heated and the administration from a medical point of view is greatly improved.

The percentages for determining the number of beds to be built have varied: for the original thirty-two base hospitals at camps and cantonments, it was 3 per cent; later, certain of these camps became replacement camps and hospitals for 4½ per cent of the personnel were provided. Embarkation camps, where a final combing out of sub-normal troops took place before sailing, were increased to 5 per cent.

CLASSIFICATION.

The following kinds of Hospitals have been built by the Construction Division:

(A) Base Hospitals at all camps and cantonments, at Coast Artillery Forts, and at war plants, such as Ordnance, Quartermaster Depots and Signal Corps camps, where large bodies of enlisted men are housed.

Note: Where the number of enlisted men has been three thousand or less, Regimental Infirmaries according to standard cantonment design, have been furnished. At the thirty-two original camps, Regimental Infirmaries were constructed for each 3,000 men in addition to the main hospital.

(B) General Hospitals for the treatment of officers and enlisted men, in general, returned from overseas, include Hospitals for consumptives, for the blind and for the reconstruction of wounded men. The first General Hospitals were constructed of the pavilion type buildings. Later, existing buildings, such as hotels, store and school buildings, were remodeled, at a minimum cost, for receiving casuals before they were distributed to the Department Hospitals.

(C) Departmental Hospitals are located at Departmental Army posts in which the barrack buildings are altered for hospital use, supplemented by additional construction of mess and kitchen, power house and special treatment buildings.

WAREHOUSES AND PORT TERMINALS.

GENERAL.

Storage and terminal facilities for military purposes, differ in their requirements from similar commercial developments based on peace-time requirements. First, it is essential that there be a standardized emergency type of construction that will provide economical semi-fireproof storage spaces, in the quickest possible time; Second, such an arrangement of buildings and supporting railroad yards, as will afford large and efficient facilities for storage and rapid handling of supplies. The facilities provided, are broadly divided into two classes: "Interior" warehouses and depots, and "Port Terminals."

INTERIOR WAREHOUSES AND DEPOTS:

Are usually located away from the seaboard. They include storage provisions for Quartermaster Corps, Ordnance Department, Medical Department, Department of Military Aeronautics, Signal Corps, etc., and are variously named. They act as reservoirs for the accumulation of large reserve supplies. In the case of interruption of overseas transportation, they relieve traffic lines of congestion, and thus prevent the slowing up of manufacturing which may be due to lack of transportation facilities, or to lack of storage capacity near points of manufacture and at port terminals. A typical example of "Interior" Depot is shown on Plate No. 100, for the Schenectady Army Reserve Depot. For typical grouping of warehouse units, see Plate No. 105.

PORT TERMINALS:

Are located at seaboard ports and should be designed with a view of provisions for:

(1) Handling—space for commodities, for immediate transfer to ships or the reverse;

(2) Reserve space for storage of commodities, pending shipment by rail or by water, which space should be sufficient to carry at least sixty days' supply, in order to guard against the contingencies, of interruption of shipping by water from any cause and the consequent slowing up of manufacture due to congestion of rail facilities.

Port terminals usually necessitate the design and construction of docks, piers and pier sheds. Frequently dredging and harbor improvements are involved; also the design and construction of lighters. Typical examples of "Port Terminals" are shown on Plate No.'s 99, 100, 101.

The head-house type of terminal, such as that built at Charleston, S. C., has advantages, due to provisions for working space in the head-house communicating with, and supported by, the storage area of the wing warehouses; see Plate No. 99.

In connection with Port Terminals, it has been found that storage areas can be arranged on the piers, in pier-sheds, to advantage. This provision reduces handling of merchandise to the minimum. An illustration of this type is the Philadelphia Q. M. Terminal, Plate No. 101.

CLASSIFICATION OF CONSTRUCTION.

Under emergency war conditions, construction provided for Interior Depots and for Port Terminals, both in this country and overseas, is divided into two classes: temporary and permanent:

Temporary warehouses are for use during emergency conditions, or for the duration of the war and during the period of demobilization, after which they may be torn down or disposed of as may be determined later.

The necessity for permanent warehouses is determined by one or more of the following factors: congested localities, where multi-story building is advisable; conditions requiring fireproof construction, in localities where permanent facilities for the Government are needed for future use; cases where satisfactory agreements can be made for turning over the properties to private ownership when the Government no longer requires their use. In the latter case, the design should be made with this possibility in mind.

TYPE OF STRUCTURE.

The type of construction to be adopted, should be determined by a study of each individual case. Many of the items affecting the selection of a site, will also influence the type of construction adopted. Other items are the following:

(a) Shape of property;

(b) Shape and nature of water frontage;

(c) Character of materials to be handled;

(d) Nature of surrounding property.

If Toredo or other destroyers of timber work are present in water, the woodwork of docks should be protected, or concrete substituted.

SITE.

Certain important features should be considered in connection with the selection of sites for Interior Depots and for Port Terminals, of either temporary or permanent character, among which are the following:

(a) Rail transportation connections;

(b) Water transportation connections;

(c) Provision for expansion;

(d) Labor for operation;

(e) Existing railroad yards and trunk line connections;

(f) Accessibility to local manufactories;

(g) Available water supply;

(h) Available electric power;

(i) Presence of Toredo or other destroyers of timber work in water, where docks, wharves, piers, etc., are necessary;

(j) Character of soil-borings for buildings;

(k) Depth of water and character of bottom soil as indicated by test piles and borings;

(l) Dredging;

(c) Character of materials to be handled;

(d) Nature of surrounding property.

If Toredo or other destroyers of timber work are present in water, the woodwork of docks should be protected, or concrete substituted.

RAILROAD FACILITIES.

The railroad facilities required in connection with either "Interior" warehouses and depots or "Port Terminals," should be such that each may form a complete unit in itself for receiving, classifying, storing and forwarding cars. In relation to this subject, there should be considered: the type of structure selected, the character of materials handled, and the nature of existing facilities. Provision for the following are generally necessary:

(a) Supporting yards;

(b) Open storage;

(c) Engine storage;

(d) Cinder pit, coal storage, water stations;

(e) Repair tracks and shop.

EQUIPMENT UTILITIES.

Due consideration should be given to the utilities broadly classified below, provisions for most of which, will usually be found necessary:

(a) Fire protection, hydrants, sprinklers (dry) (wet) elevated tanks; storage tanks and pumps;

(b) Water supply for domestic uses;

(c) Electricity (light-power); protective lighting; fire alarm; telephones;

(d) Elevators and spiral chutes, cargo whips, cranes;

(e) Mobile equipment (electric tractors with trailers, battery charging room and equipment; locomotives and locomotive cranes);

(f) Machine shop;

(g) Garage;

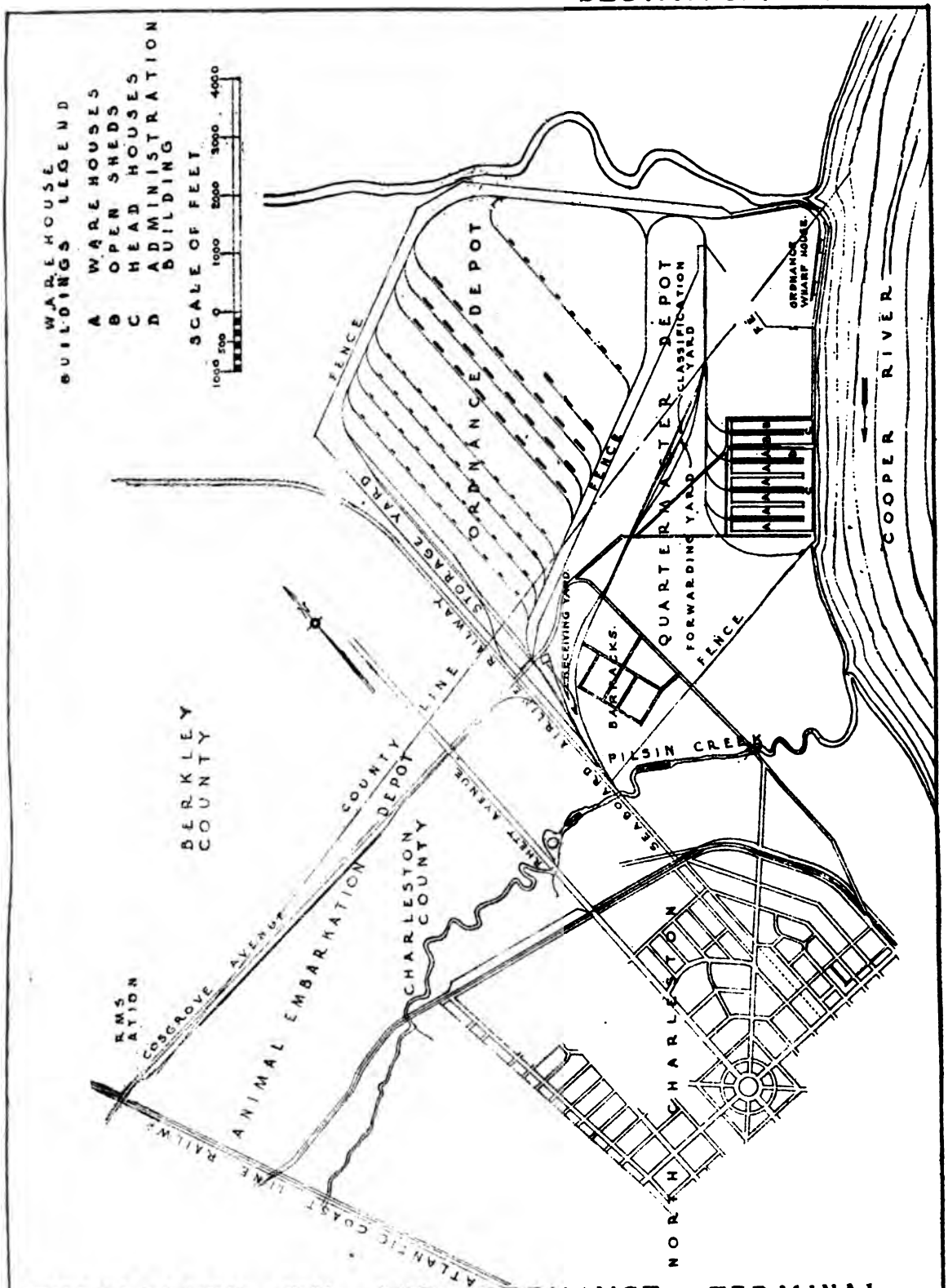
(h) Roads;

(i) Boiler house; coal storage;

(j) Heating facilities;

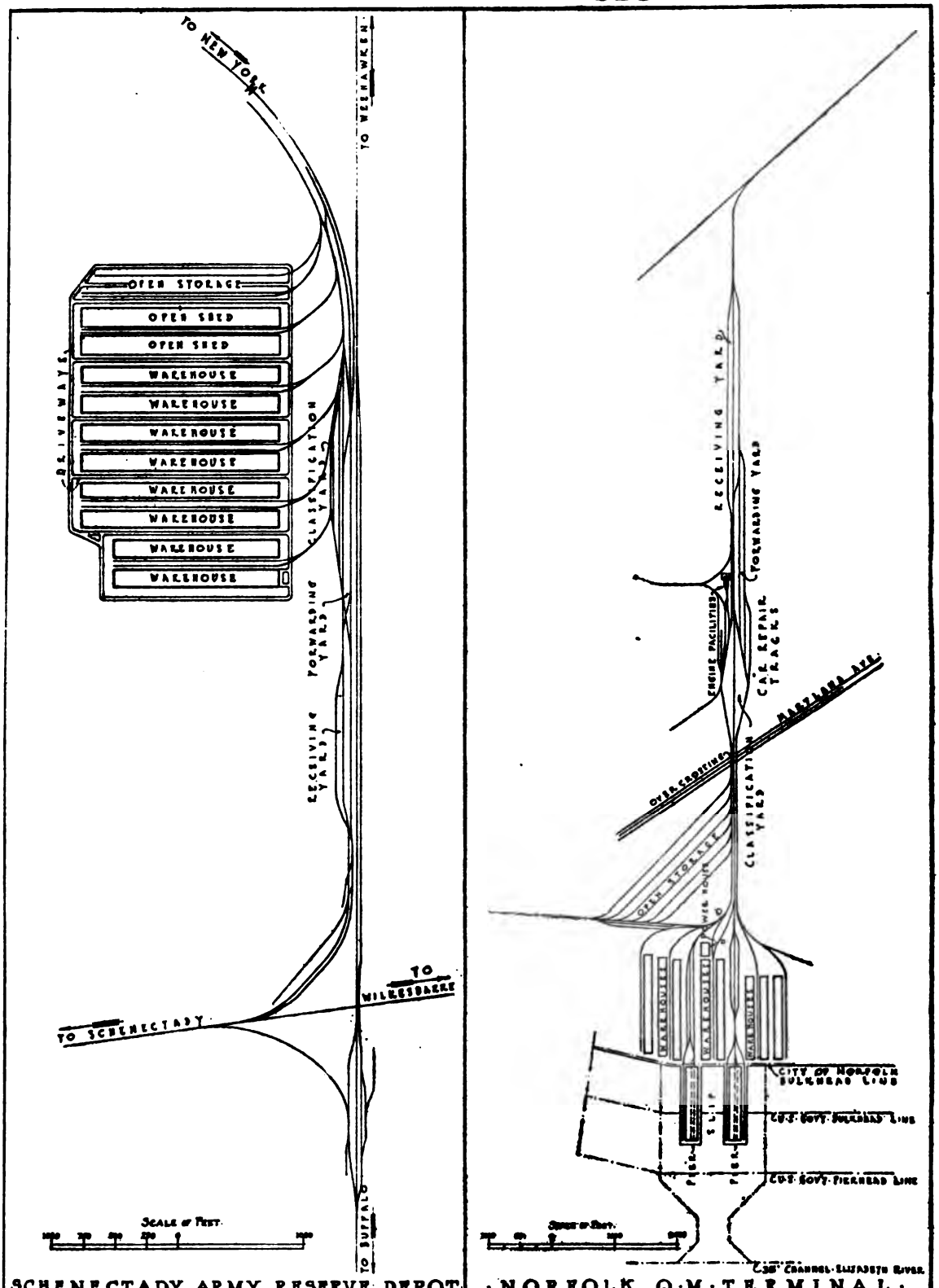
(k) Barracks and quarters;

(l) Fences.



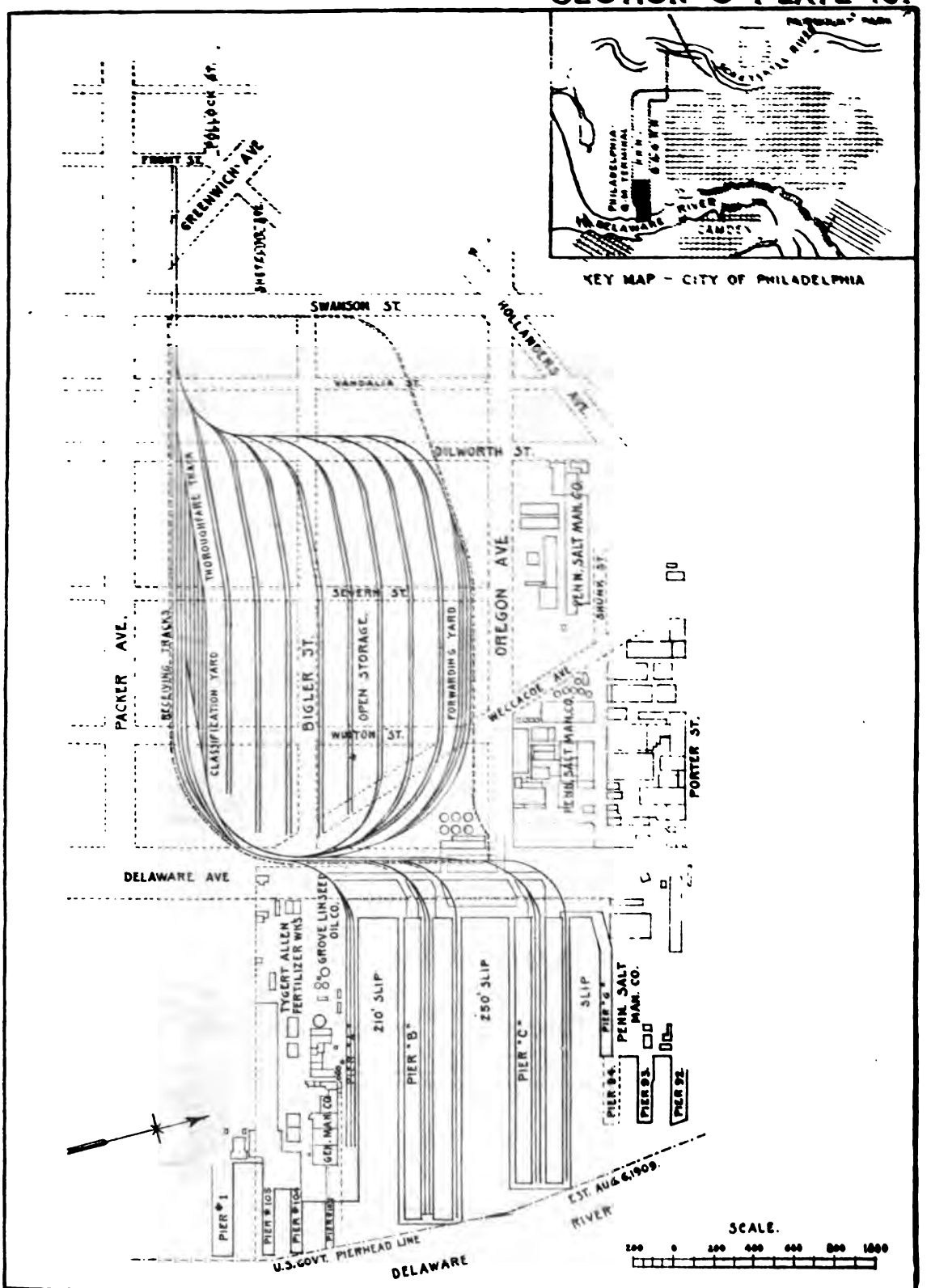
CHARLESTON Q.M. AND ORDNANCE TERMINAL

CONSTRUCTION DIVISION OF THE ARMY
· TERMINAL ·
GENERAL PLAN

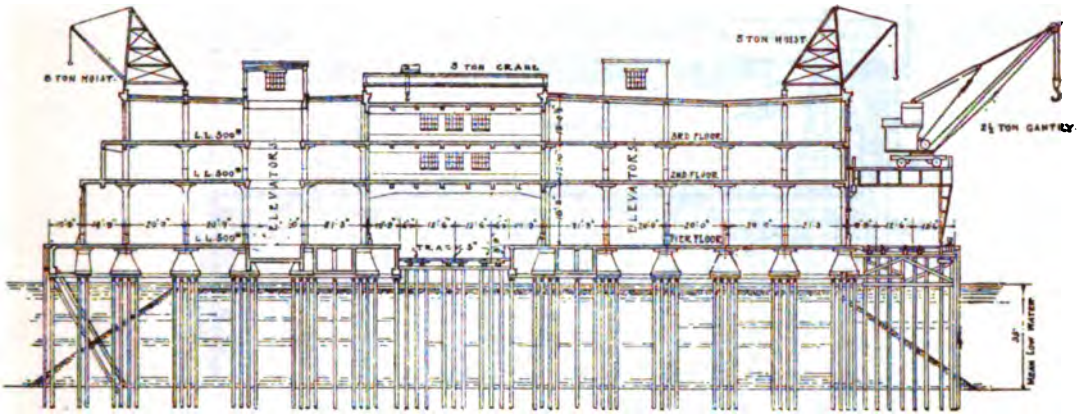


SCHENECTADY ARMY RESERVE DEPOT · NORFOLK Q·M·TERMINAL·

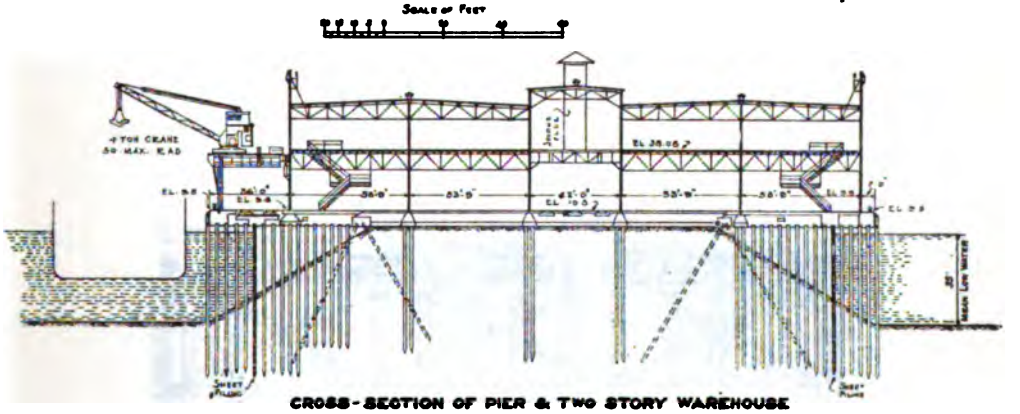
CONSTRUCTION DIVISION OF THE ARMY
· TERMINALS ·
GENERAL PLANS



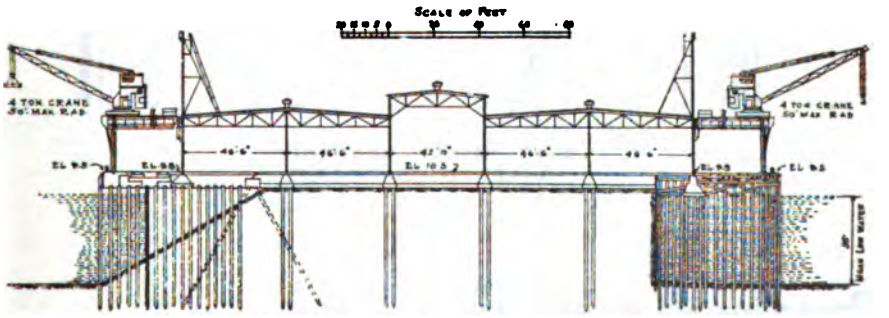
CONSTRUCTION DIVISION OF THE ARMY
PHILADELPHIA Q.M. TERMINAL
GENERAL PLAN



CROSS-SECTION OF PIER & WAREHOUSE
PHILADELPHIA Q.M. TERMINAL

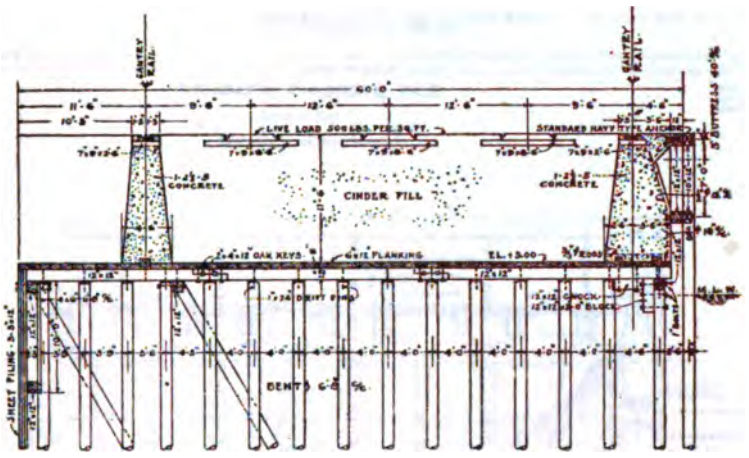


CROSS-SECTION OF PIER & TWO STORY WAREHOUSE
NORFOLK Q.M. TERMINAL

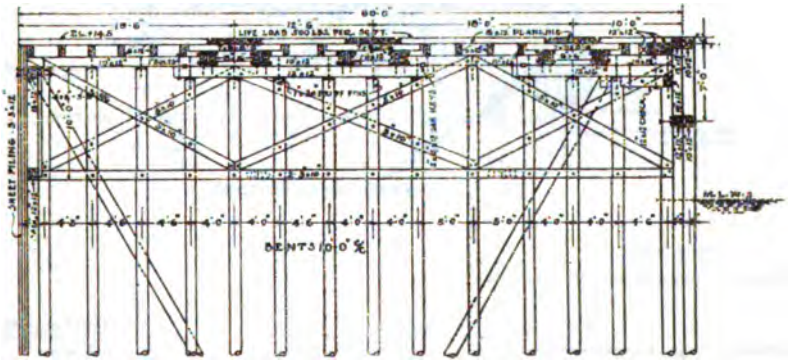


CROSS-SECTION OF PIER & ONE STORY WAREHOUSE
NORFOLK Q.M. TERMINAL

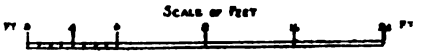
CONSTRUCTION DIVISION OF THE ARMY
CROSS-SECTIONS OF
STANDARD PIERS AND WAREHOUSES



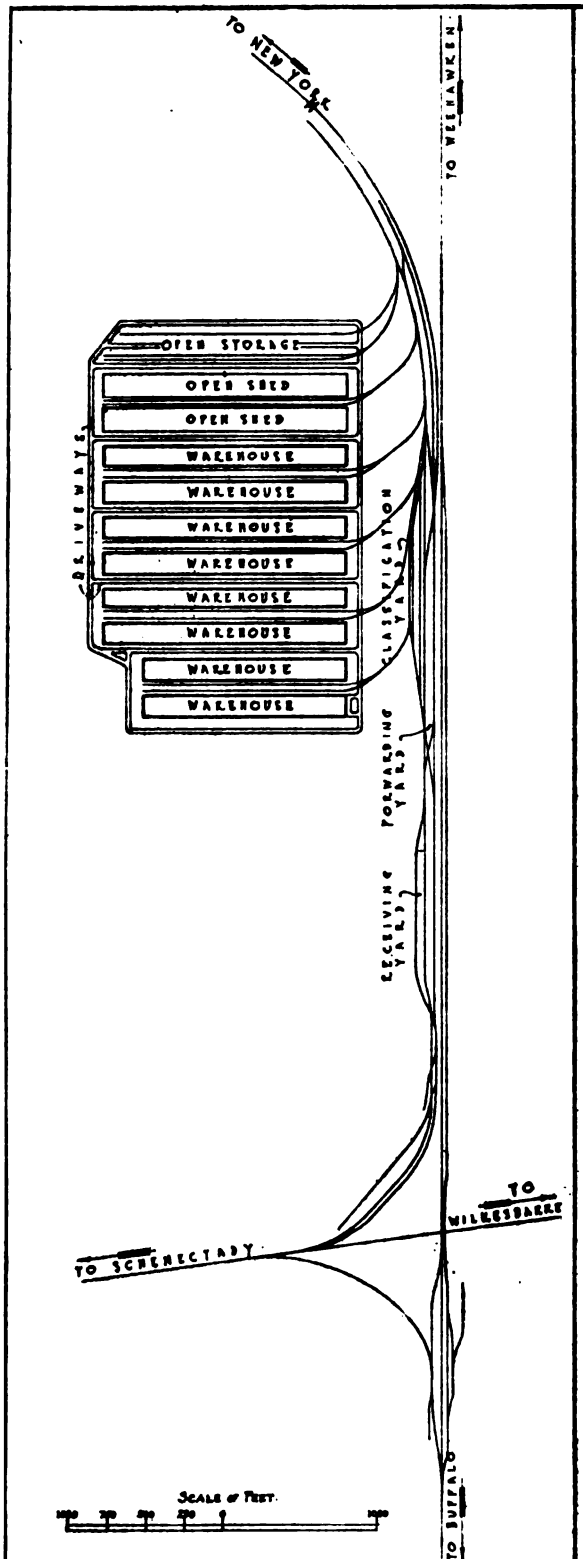
LOW WATER CUT-OFF TYPE
FOR GANTRY CRANE



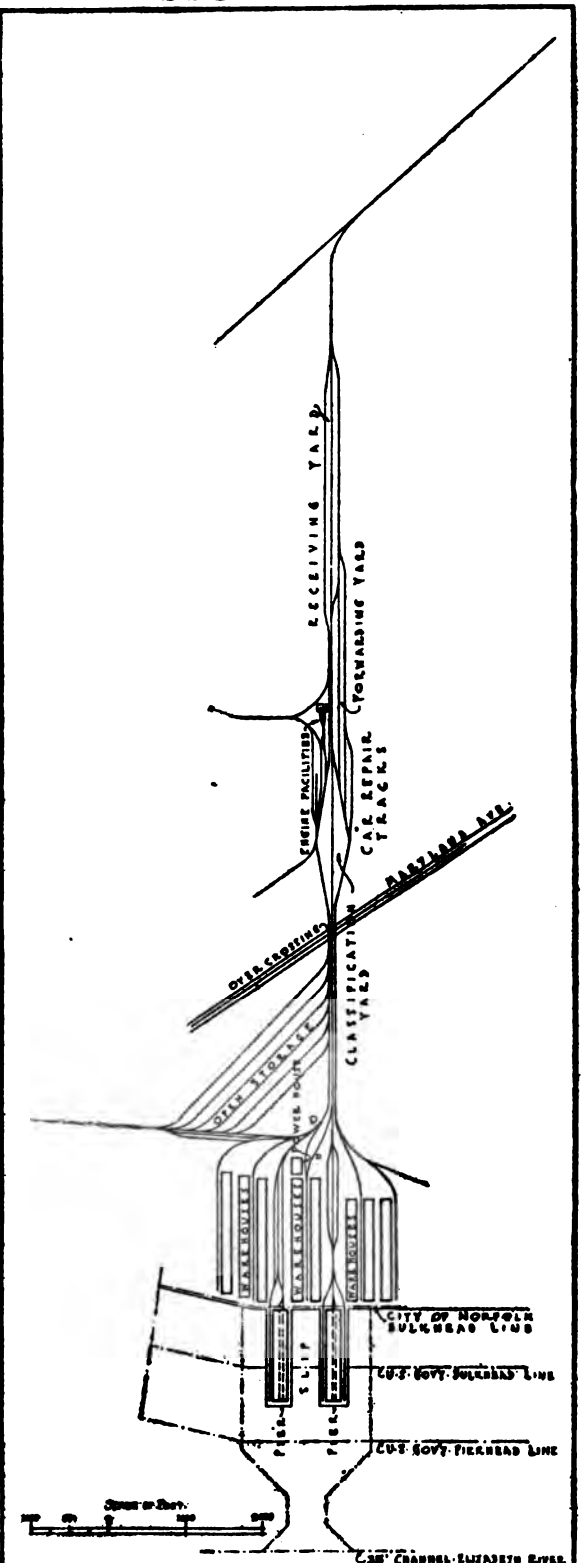
STANDARD WOODEN TYPE
FOR LOCOMOTIVE CRANE



CONSTRUCTION DIVISION OF THE ARMY
CROSS-SECTIONS OF
STANDARD TIMBER WHARVES



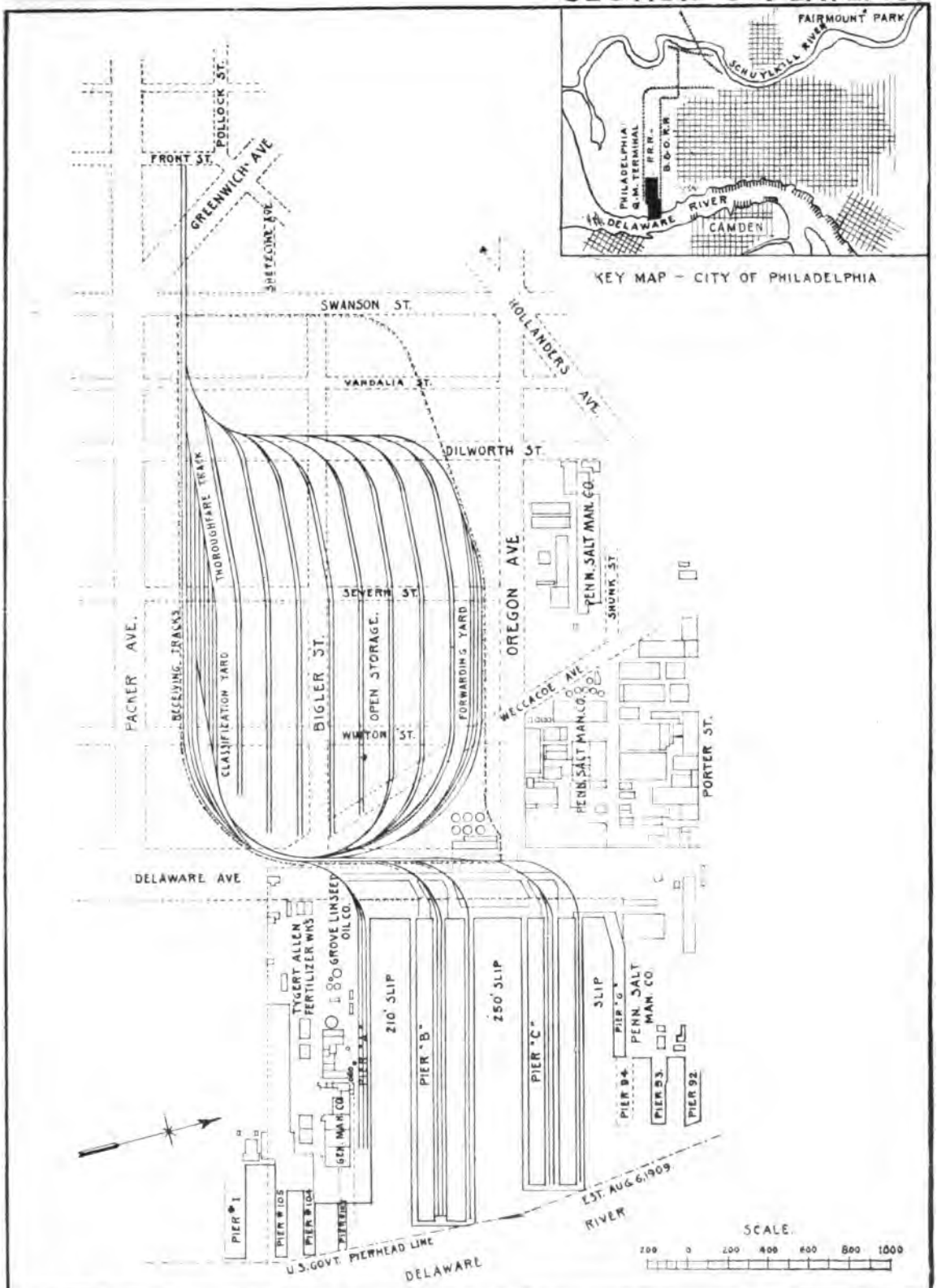
SCHENECTADY ARMY RESERVE DEPOT



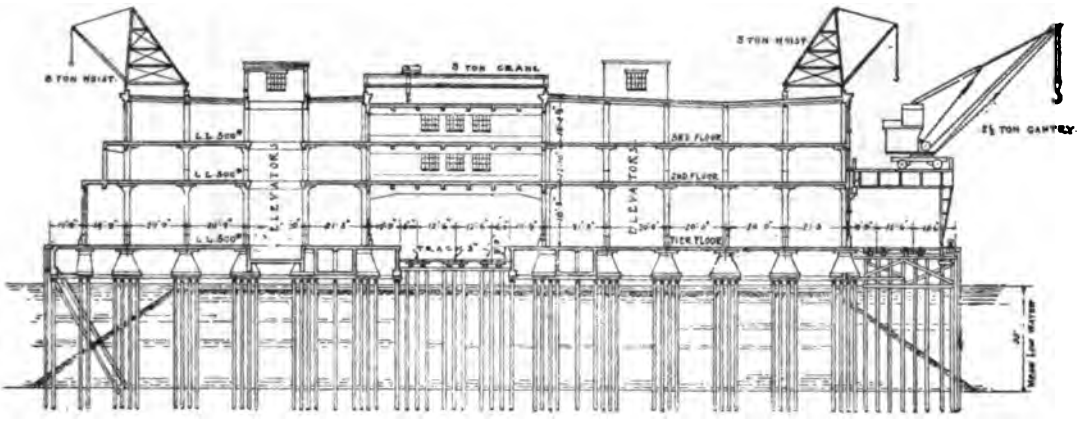
NORFOLK Q.M. TERMINAL

CONSTRUCTION DIVISION OF THE ARMY
TERMINALS
GENERAL PLANS

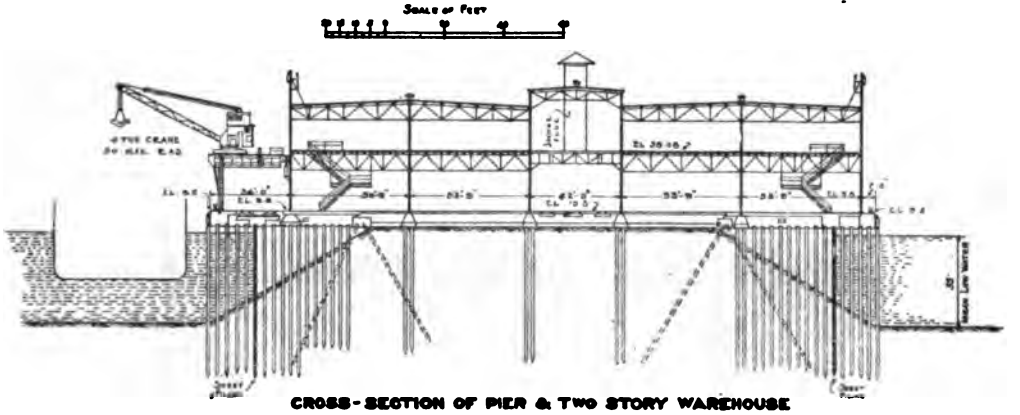
SECTION C · PLATE 101



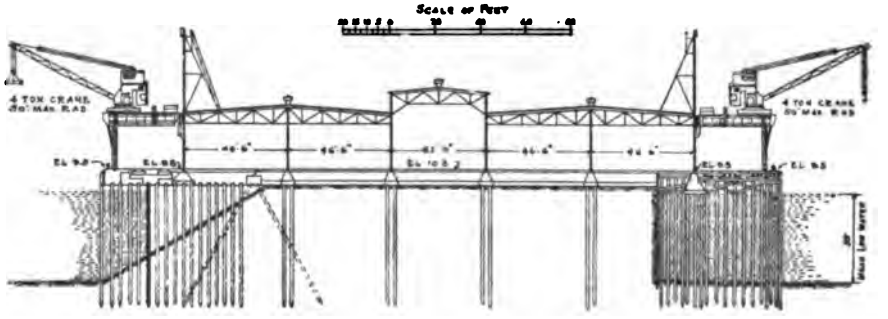
CONSTRUCTION DIVISION OF THE ARMY
PHILADELPHIA Q.M. TERMINAL
GENERAL PLAN



CROSS-SECTION OF PIER & WAREHOUSE
PHILADELPHIA Q.M. TERMINAL

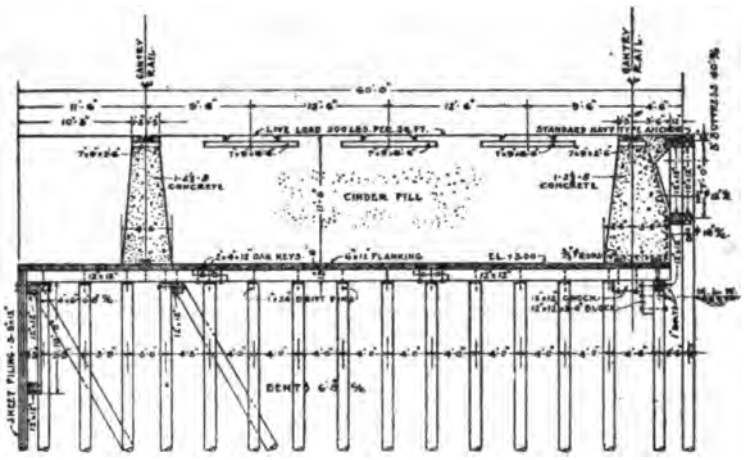


CROSS-SECTION OF PIER & TWO STORY WAREHOUSE
NORFOLK Q.M. TERMINAL

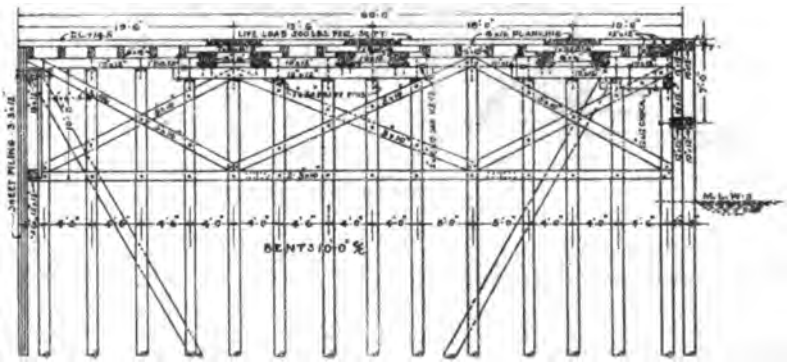


CROSS-SECTION OF PIER & ONE STORY WAREHOUSE
NORFOLK Q.M. TERMINAL

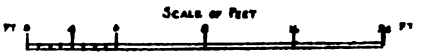
CONSTRUCTION DIVISION OF THE ARMY
CROSS-SECTIONS OF
STANDARD PIERS AND WAREHOUSES



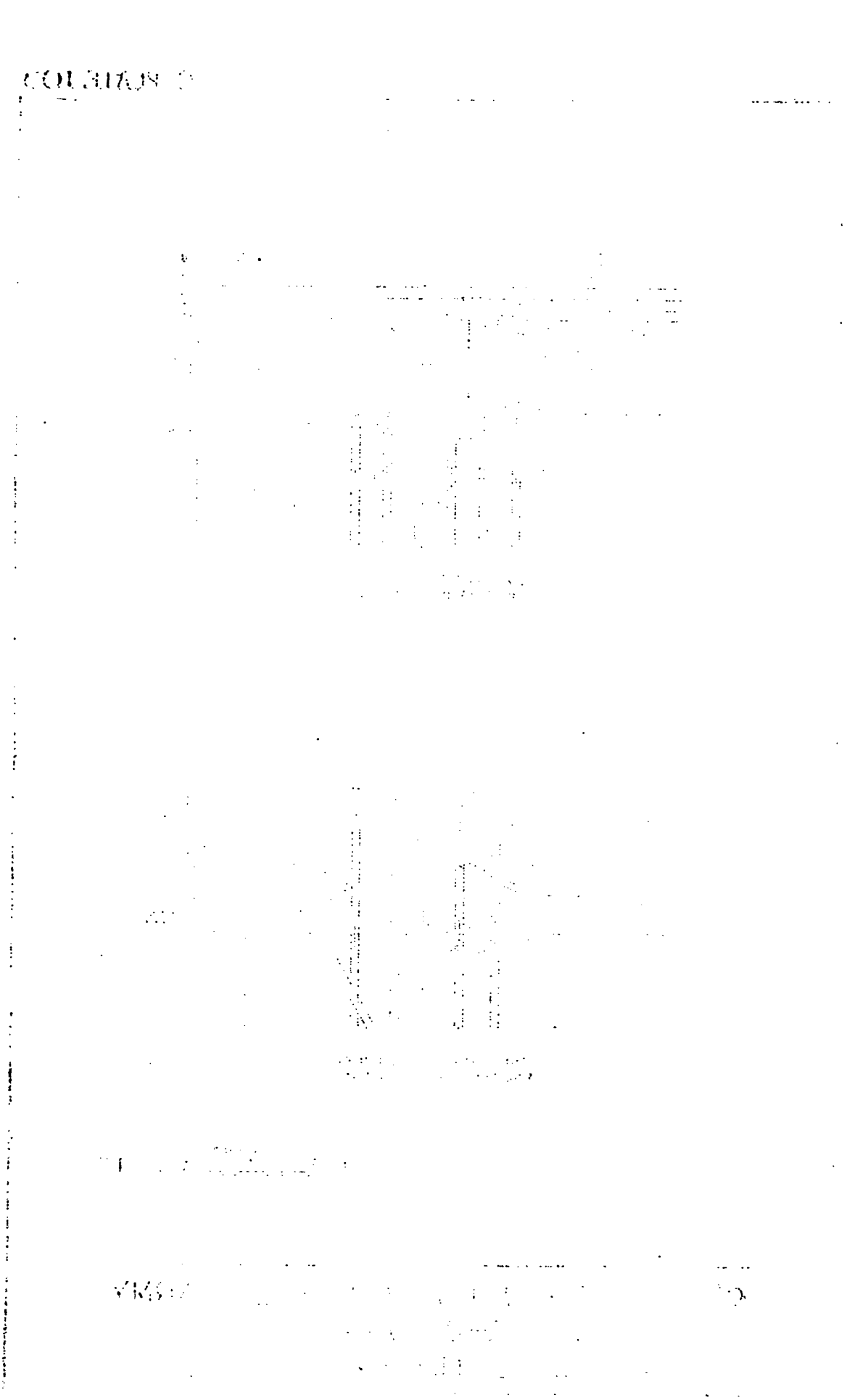
LOW WATER CUT-OFF TYPE
FOR GANTRY CRANE

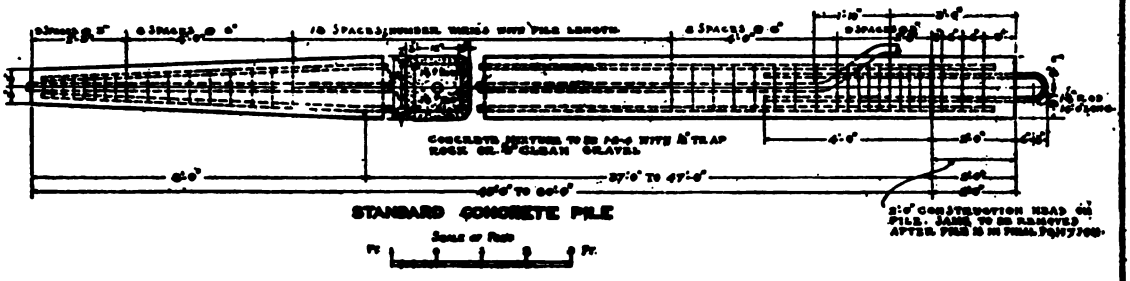


STANDARD WOODEN TYPE
FOR LOCOMOTIVE CRANE

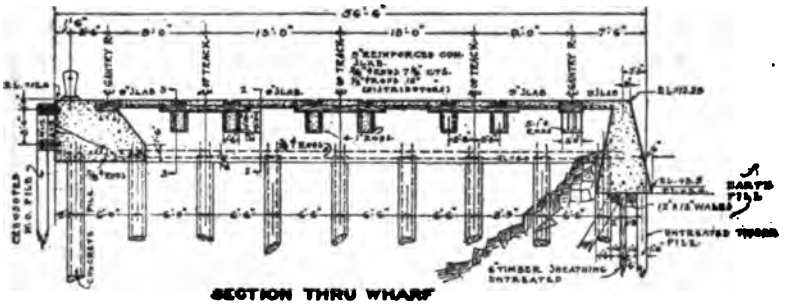


CONSTRUCTION DIVISION OF THE ARMY
CROSS-SECTIONS OF
STANDARD TIMBER WHARVES

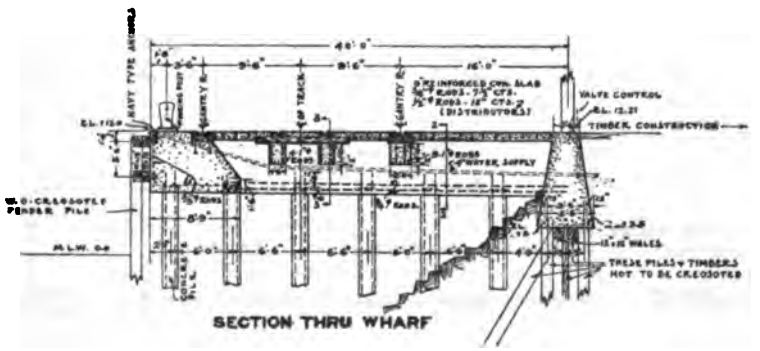




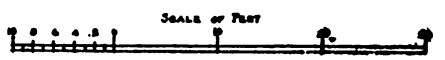
STANDARD CONCRETE PILE

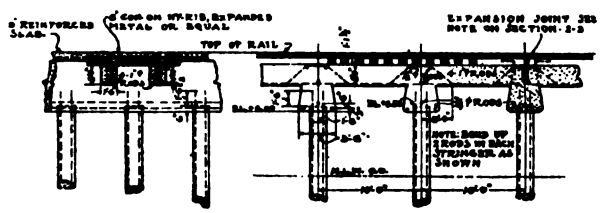


SECTION THRU WHARF

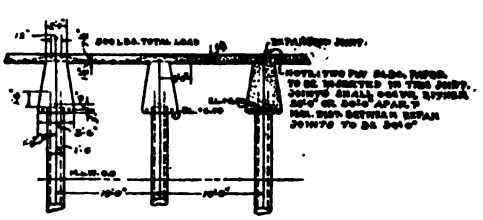


SECTION THRU WHARF



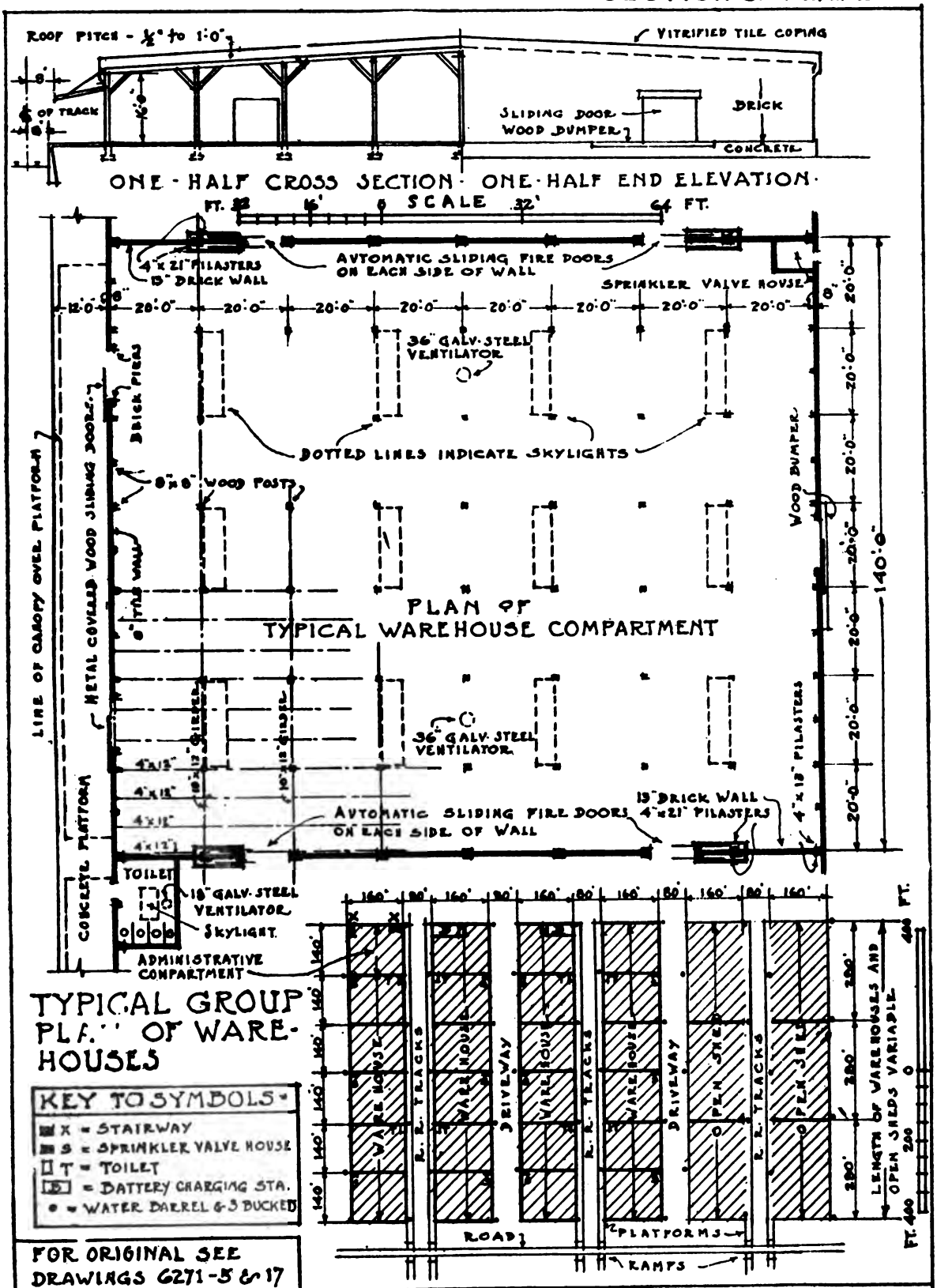


SECTION ON LINE 3-3



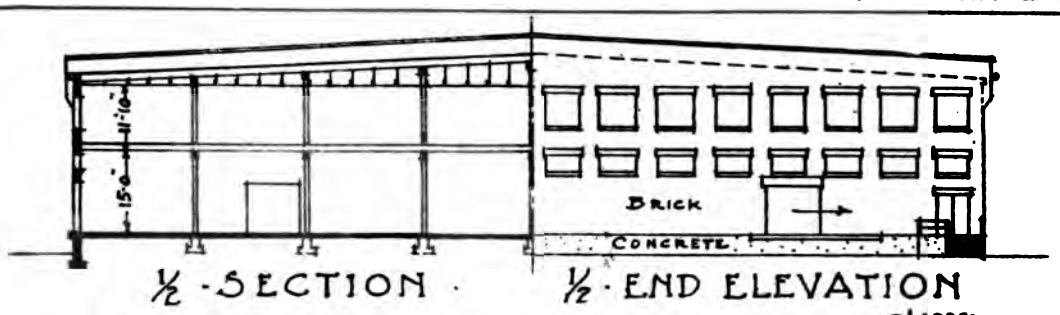
SECTION ON LINE 2-2

CONSTRUCTION DIVISION OF THE ARMY
CROSS-SECTIONS OF
REINFORCED CONCRETE WHARF

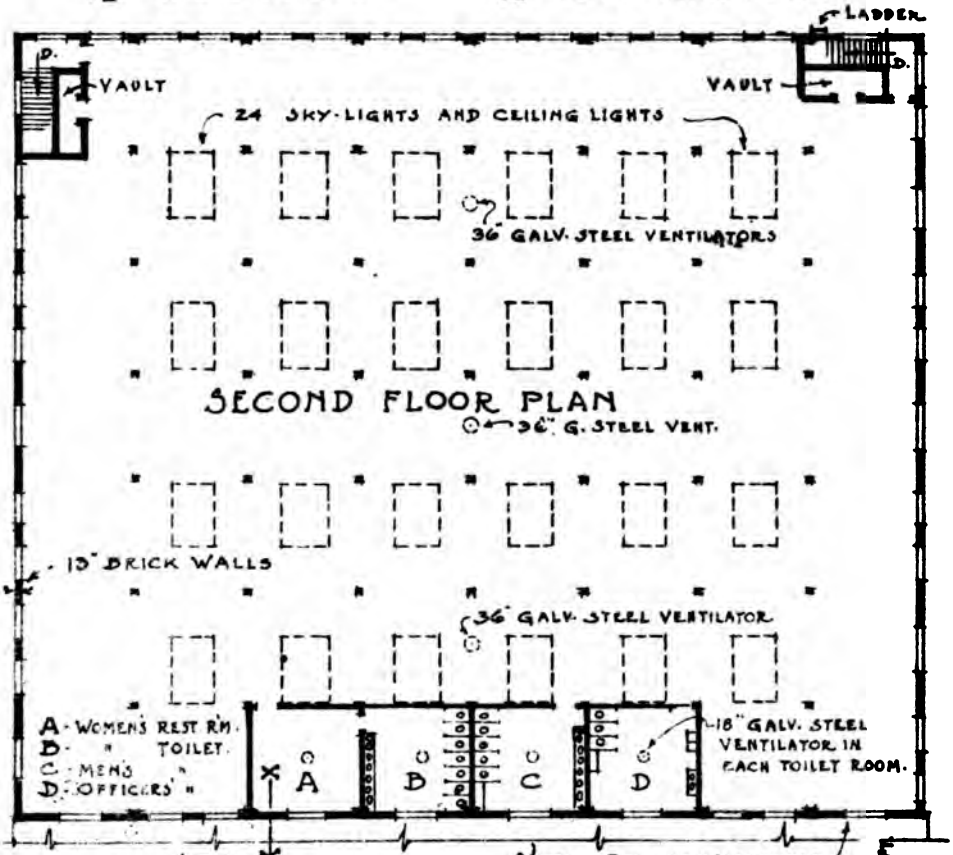


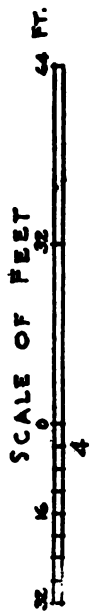
FOR ORIGINAL SEE DRAWINGS 6271-5 & 17

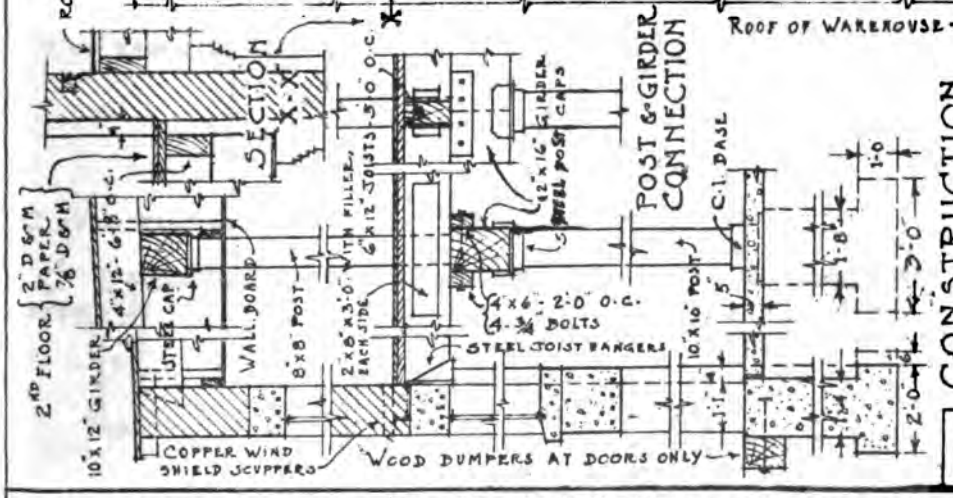
CONSTRUCTION DIVISION OF THE ARMY
TYPICAL EMERGENCY STORAGE WAREHOUSE
TYPICAL COMPARTMENT & GROUP PLAN



½ - SECTION - ½ - END ELEVATION







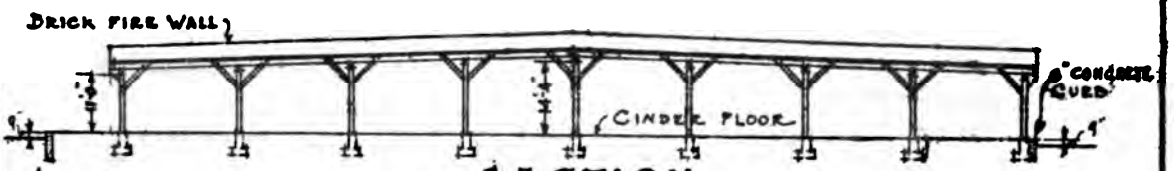
CONSTRUCTION DETAILS SCALE - FEET

NOTE - FIRST FLOOR PLAN IS SIMILAR TO THAT OF ONE-STORY WAREHOUSES - EXCEPT STAIRWAYS AND BRICK INSTEAD OF TILE WALLS.

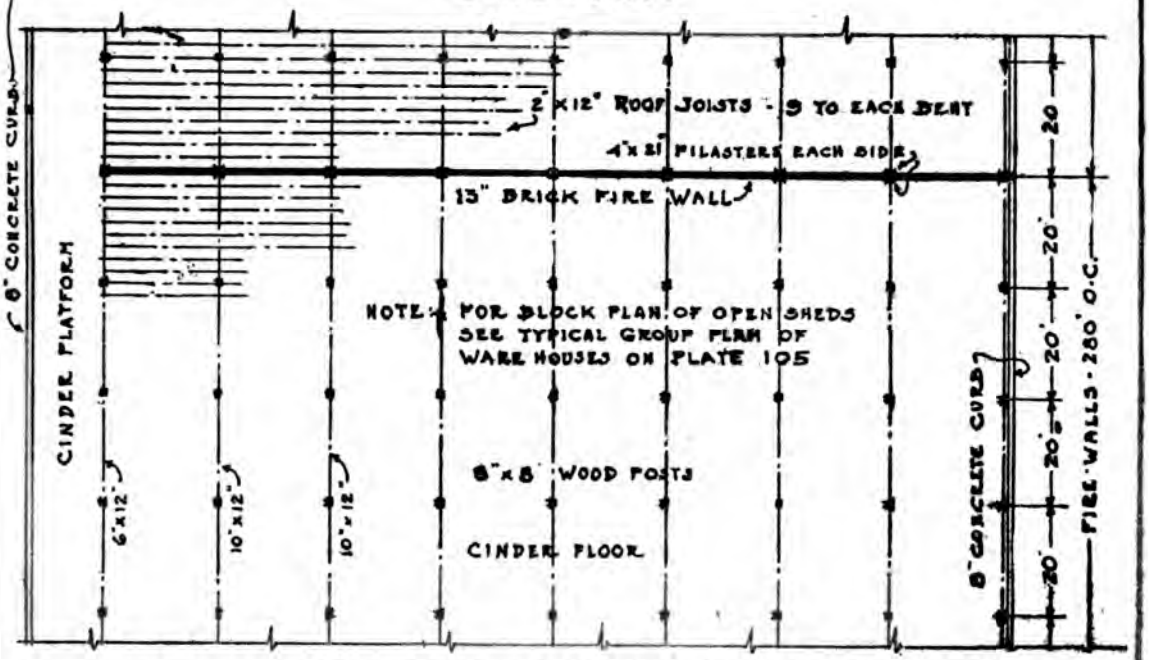
FOR ORIGINAL SEE DRAWING NO. 6271-7.

CONSTRUCTION DIVISION OF THE ARMY

TYPICAL EMERGENCY STORAGE WAREHOUSE ADMINISTRATION BUILDING

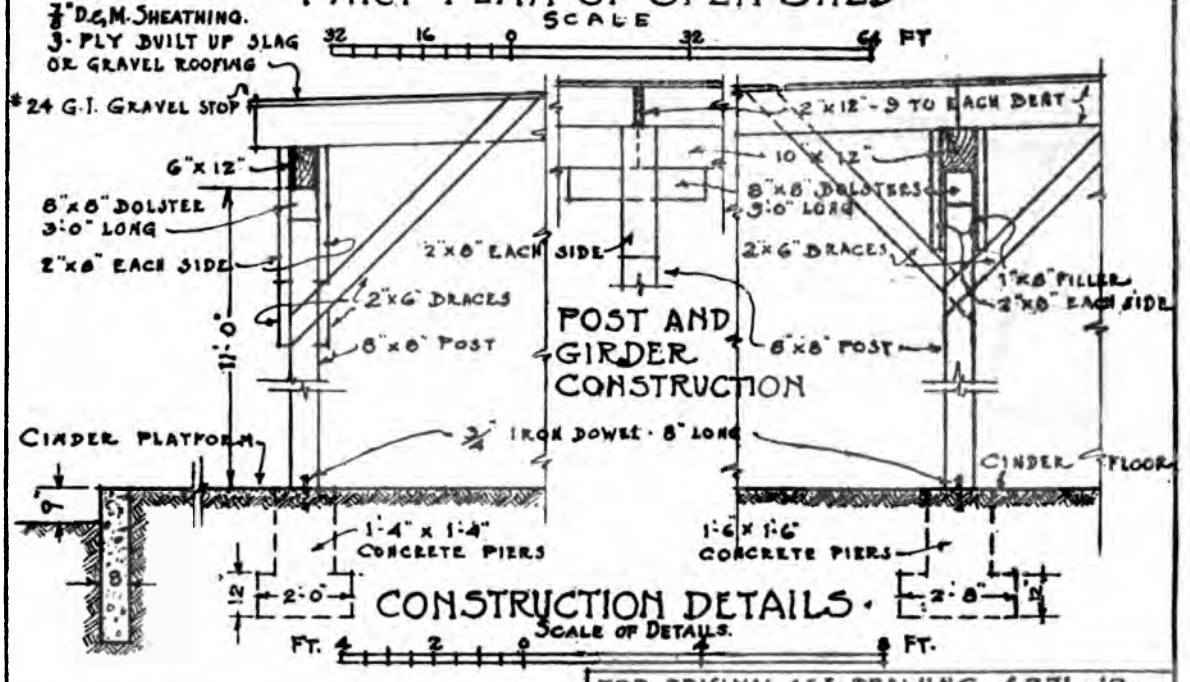


SECTION



PART PLAN OF OPEN SHED

SCALE 32 16 0 32 64 FT



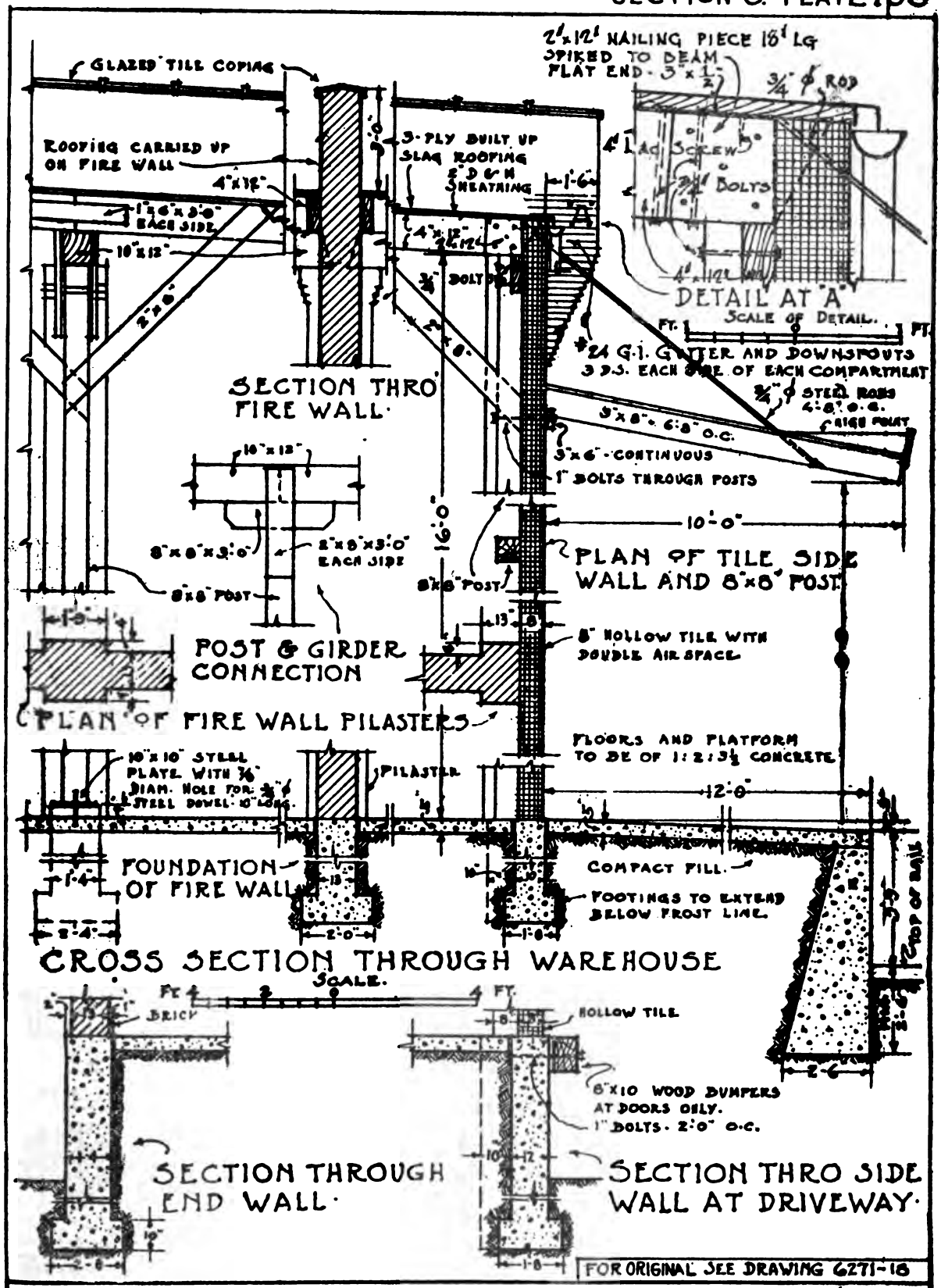
CONSTRUCTION DETAILS.

FOR ORIGINAL SEE DRAWING 6271-12.

CONSTRUCTION DIVISION OF THE ARMY

TYPICAL EMERGENCY STORAGE WAREHOUSE

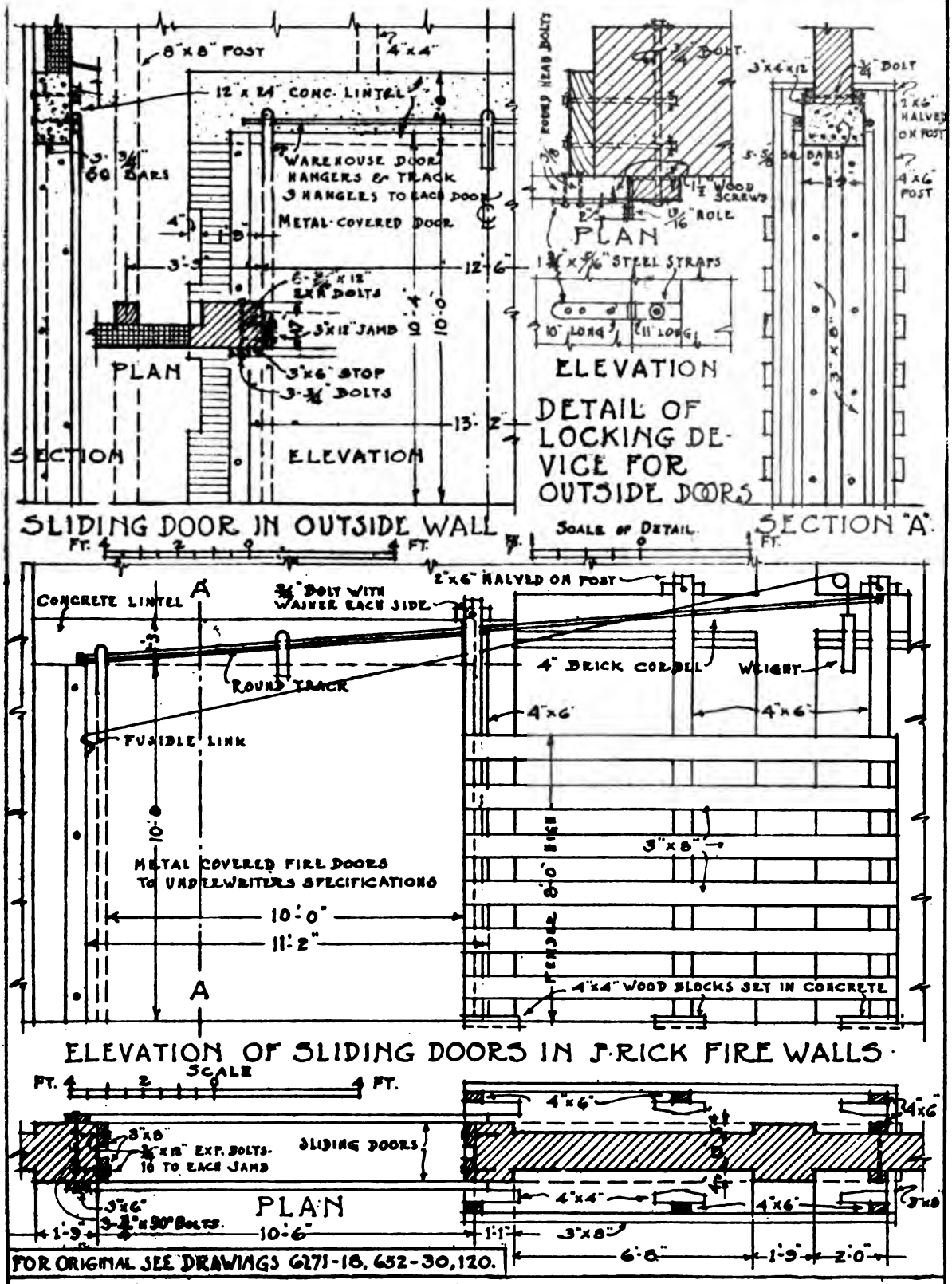
PLAN, SECTION & DETAILS OF OPEN SHED


GLAZED TILE COPING
ROOFING CARRIED UP ON FIRE WALL
3-PLY BUILT UP SLAG ROOFING
2"x12" NAILING PIECE 18' LG SPIKED TO BEAM
FLAT END - 3"x1½"
¾" ϕ ROD
Adj. SCREW
BOLTS
DETAIL AT "A"
SCALE OF DETAIL
24 G.I. GUTTER AND DOWNSPOUTS 3 D.S. EACH SIDE OF EACH COMPARTMENT
¾" ϕ STEEL RODS 4'-8" O.C.
3"x8"-6'-8" O.C.
3"x6"-CONTINUOUS
1" BOLTS THROUGH POSTS
SECTION THRO FIRE WALL
10'-0"
PLAN OF TILE SIDE WALL AND 8"x8" POST
8" HOLLOW TILE WITH DOUBLE AIR SPACE
POST & GIRDER CONNECTION
PLAN OF FIRE WALL PILASTERS
FLOORS AND PLATFORM TO BE OF 1:2:3½ CONCRETE
12'-0"
10"x10" STEEL PLATE WITH ⅜" DIAM. HOLE FOR ¾" ϕ STEEL DOWEL 10" LONG
PILASTER
FOUNDATION OF FIRE WALL
COMPACT FILL
FOOTINGS TO EXTEND BELOW FROST LINE
CROSS SECTION THROUGH WAREHOUSE
SCALE
BRICK
HOLLOW TILE
6"x10 WOOD BUMPERS AT DOORS ONLY.
1" BOLTS - 2'-0" O.C.
SECTION THROUGH END WALL
SECTION THRO SIDE WALL AT DRIVEWAY

FOR ORIGINAL SEE DRAWING 6271-18

CONSTRUCTION DIVISION OF THE ARMY

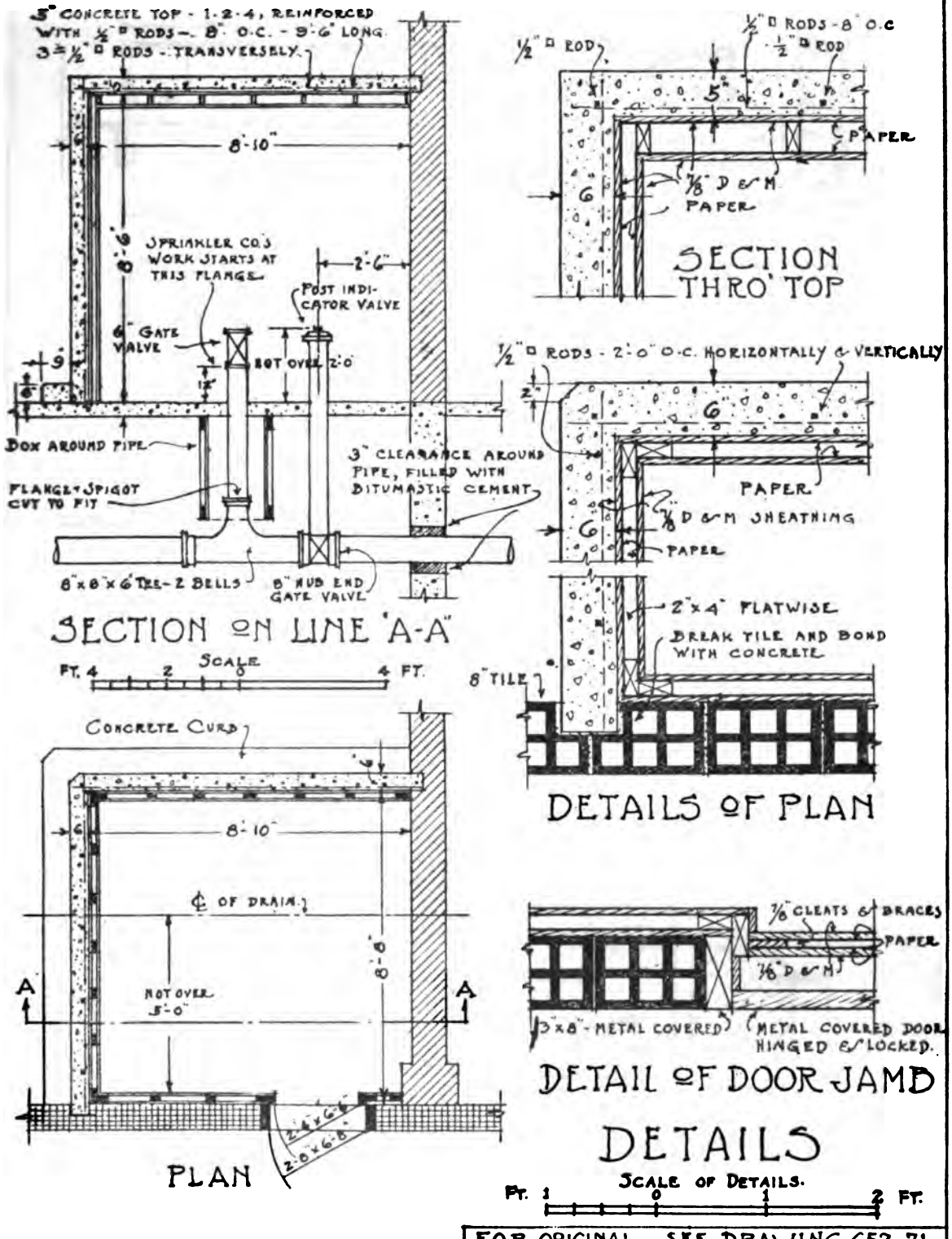
TYPICAL EMERGENCY STORAGE WAREHOUSE CONSTRUCTION DETAILS



FOR ORIGINAL SEE DRAWINGS 6271-18, 652-30, 120.

CONSTRUCTION DIVISION OF THE ARMY

TYPICAL EMERGENCY STORAGE WAREHOUSE DOOR DETAILS

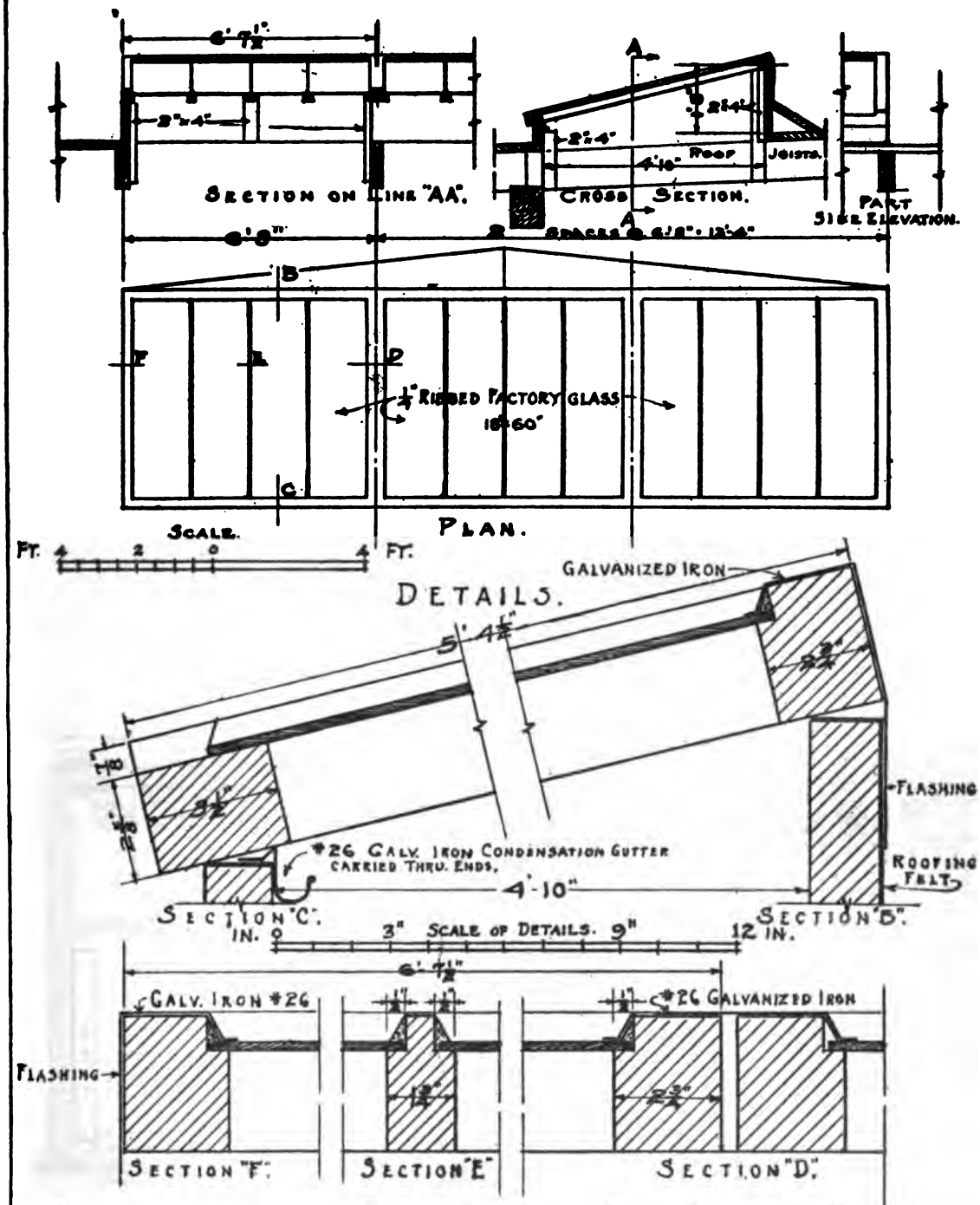


FOR ORIGINAL SEE DRAWING 652-71

CONSTRUCTION DIVISION OF THE ARMY

TYPICAL EMERGENCY STORAGE WAREHOUSE

SPRINKLER VALVE HOUSE



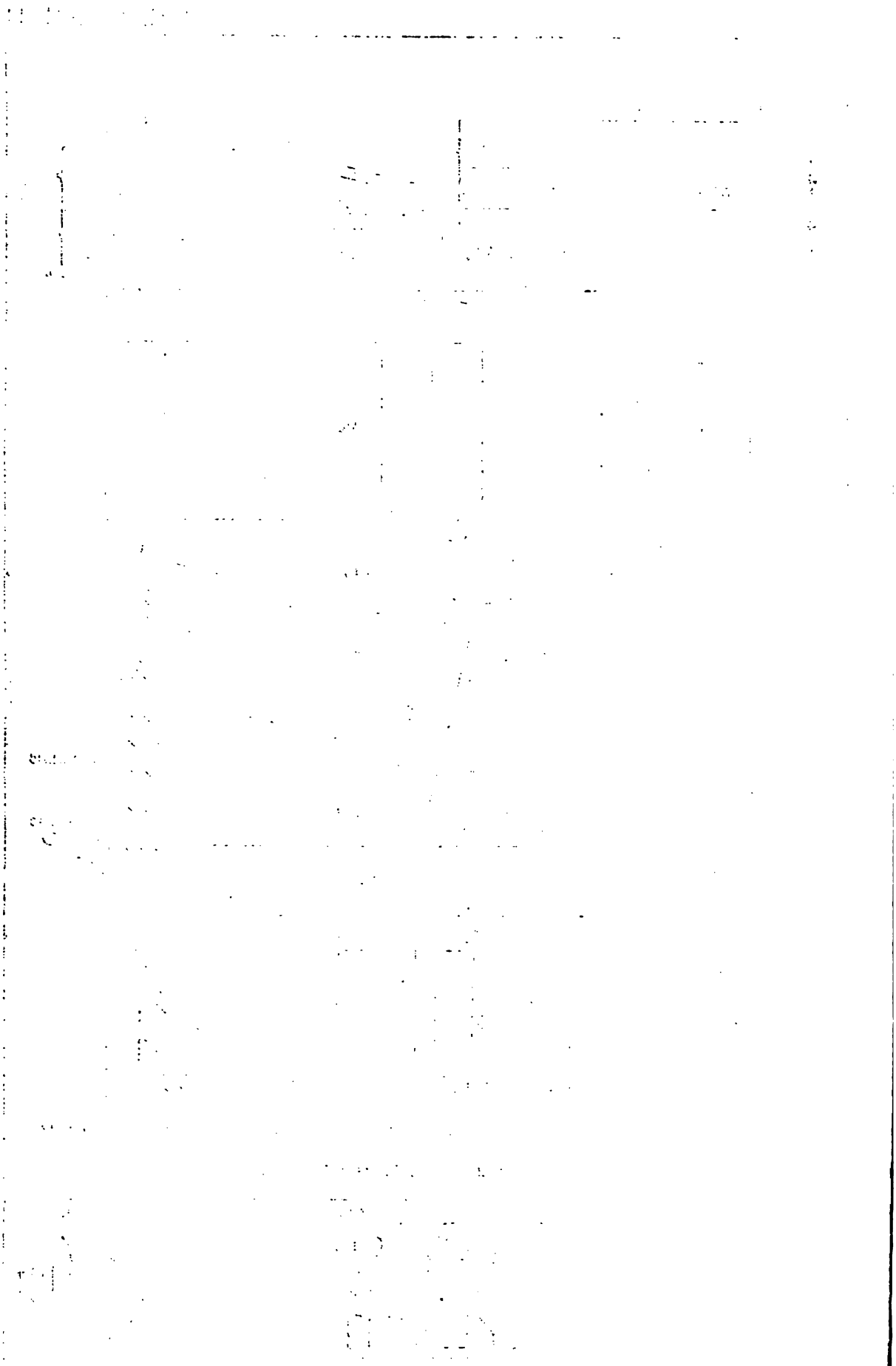
SASH TO BE WHITE PINE WITH MORTISE AND TENON JOINTS MADE IN WHITE LEAD. PRIME AT FACTORY BEFORE GLAZING.
PUTTY TO BE WHITING AND LINSEED OIL, OR FRED KUHL'S GLAZING COMPOUND, OR EQUAL.

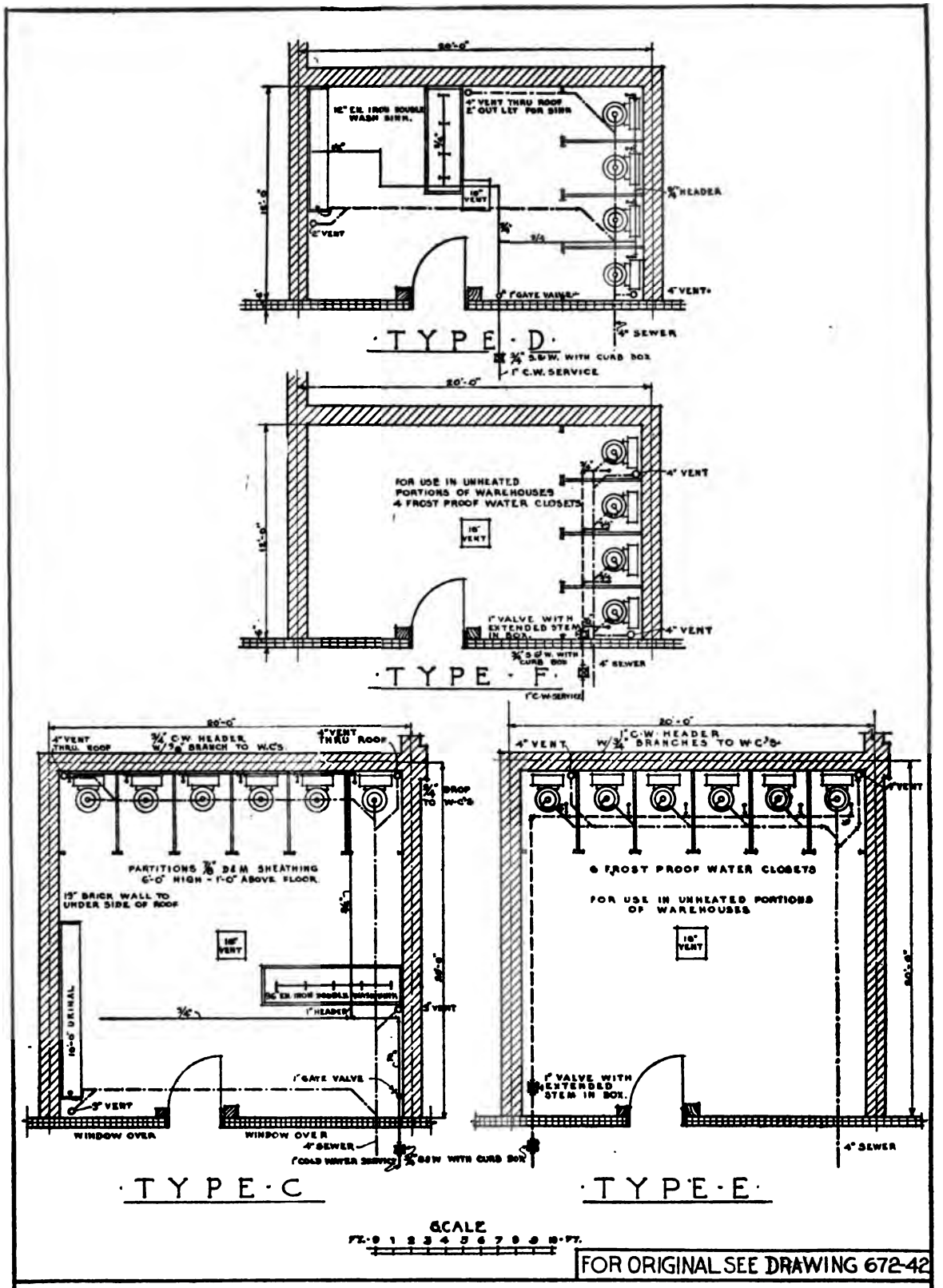
FOR ORIGINAL SEE DRAWING 652-90.

CONSTRUCTION DIVISION OF THE ARMY

TYPICAL EMERGENCY STORAGE WAREHOUSE

WOOD SKYLIGHT DETAILS

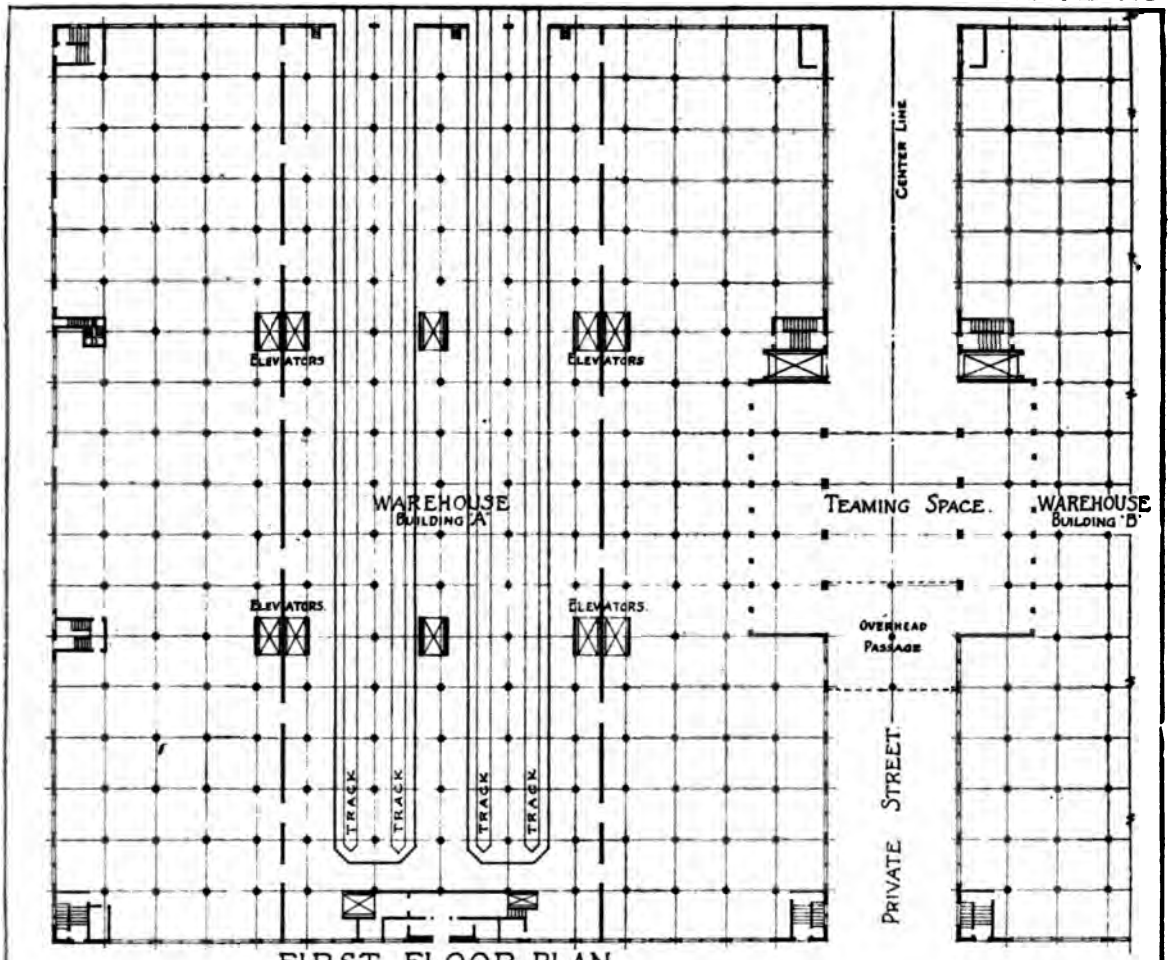




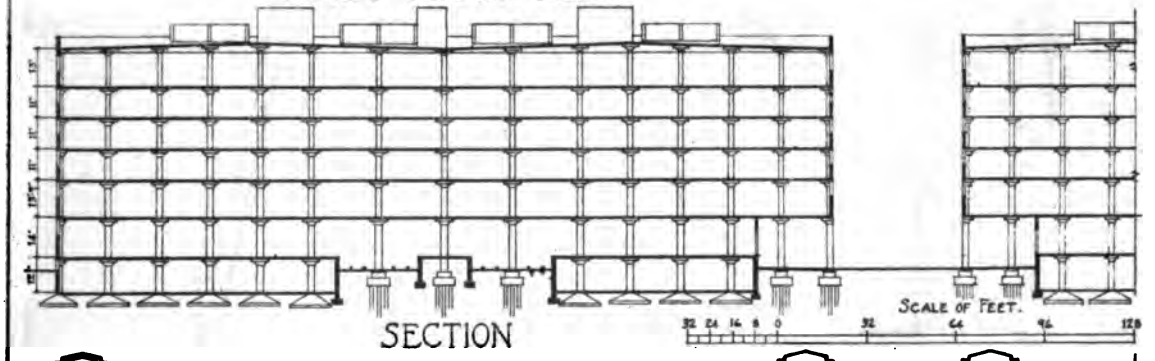
FOR ORIGINAL SEE DRAWING 672-42

CONSTRUCTION DIVISION OF THE ARMY

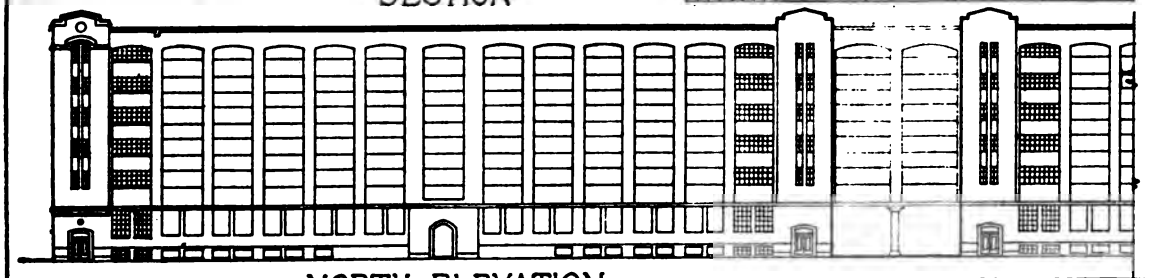
TYPICAL EMERGENCY STORAGE WAREHOUSE STANDARD TOILET ROOMS



FIRST FLOOR PLAN



SECTION

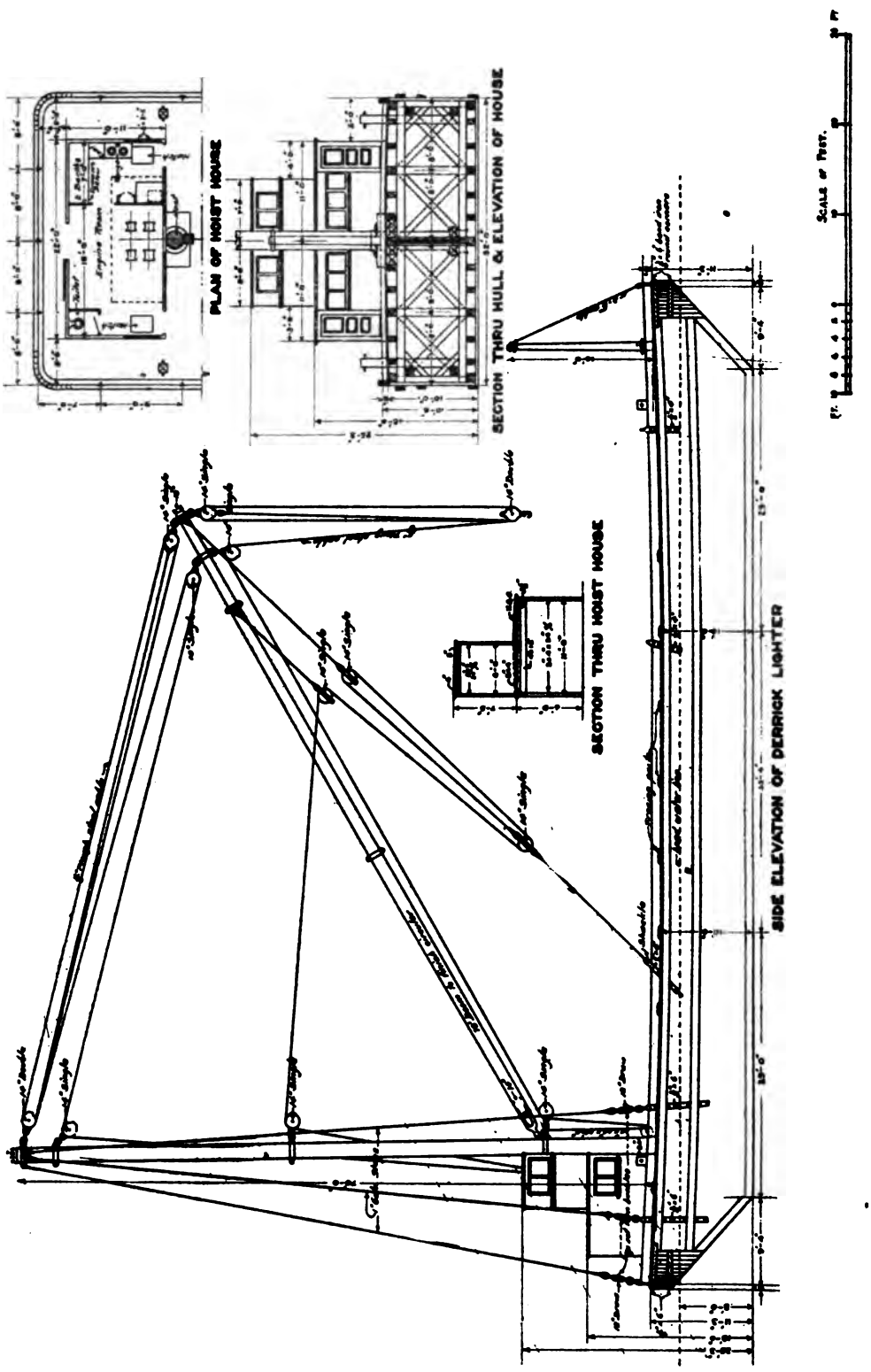


NORTH ELEVATION

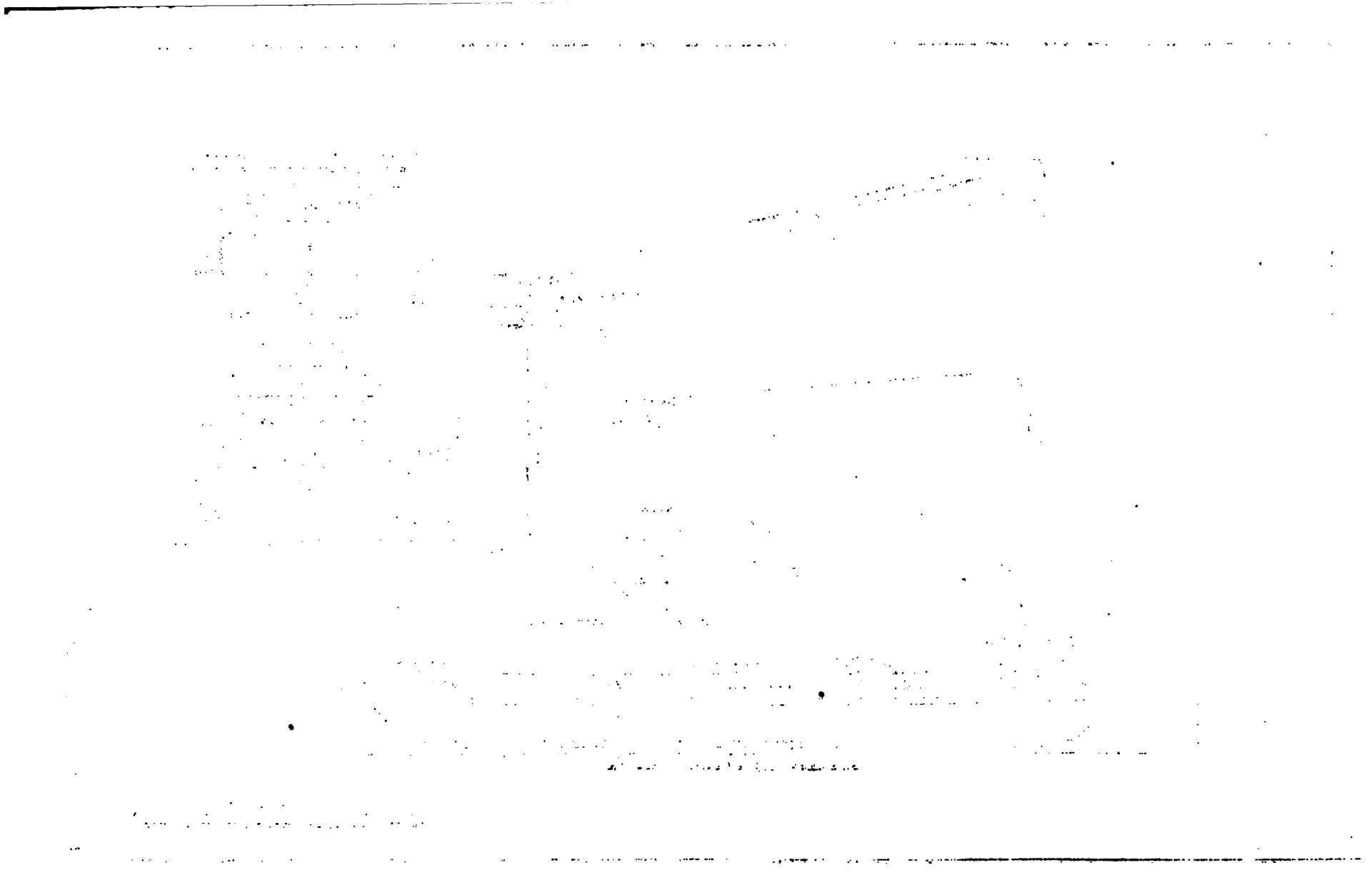
FOR ORIGINAL SEE DRWGS. 6251 - 12 to 25.

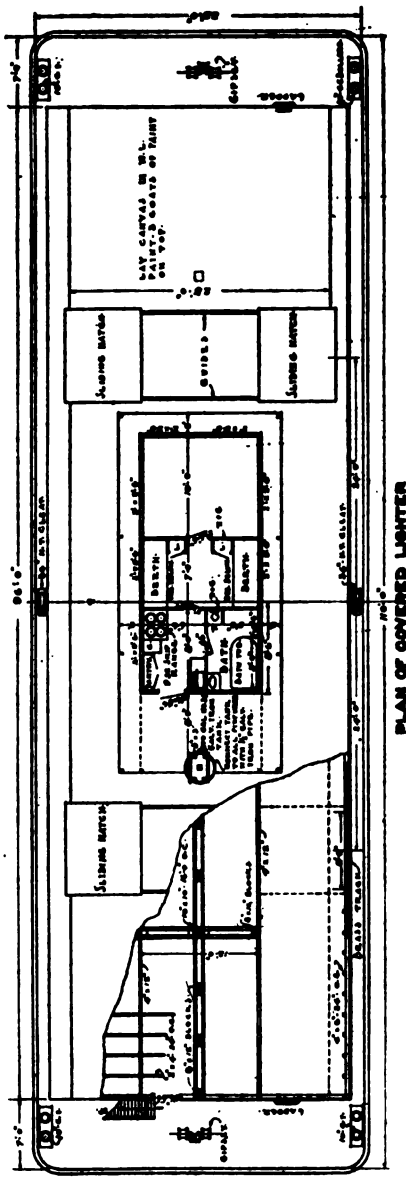
CONSTRUCTION DIVISION OF THE ARMY

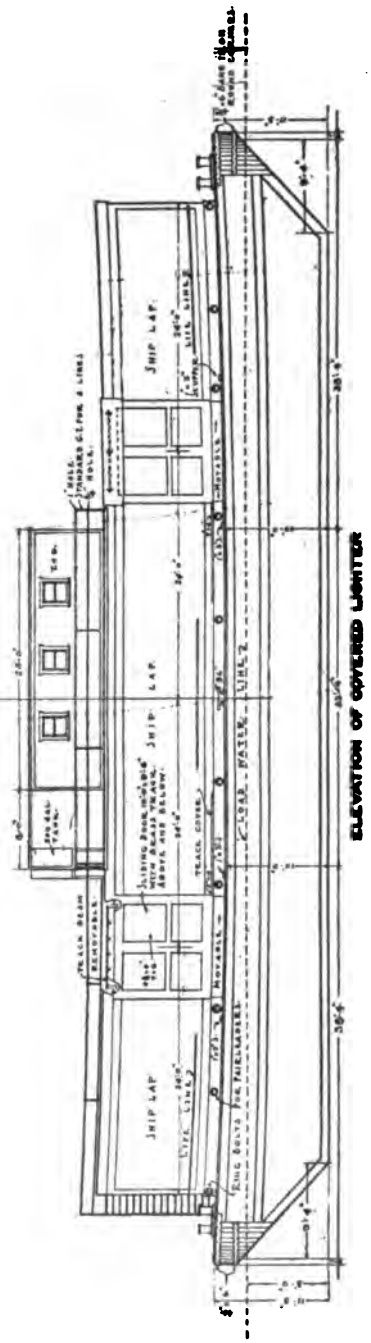
CHICAGO INTERIOR PERMANENT STORAGE WAREHOUSES


PLAN OF HOIST HOUSE
SECTION THRU HULL & ELEVATION OF HOUSE
SECTION THRU HOIST HOUSE
SIDE ELEVATION OF DERRICK LIGHTER
SCALE OF FEET.

CONSTRUCTION DIVISION OF THE ARMY
DETAILS OF
STANDARD DERRICK LIGHTERS



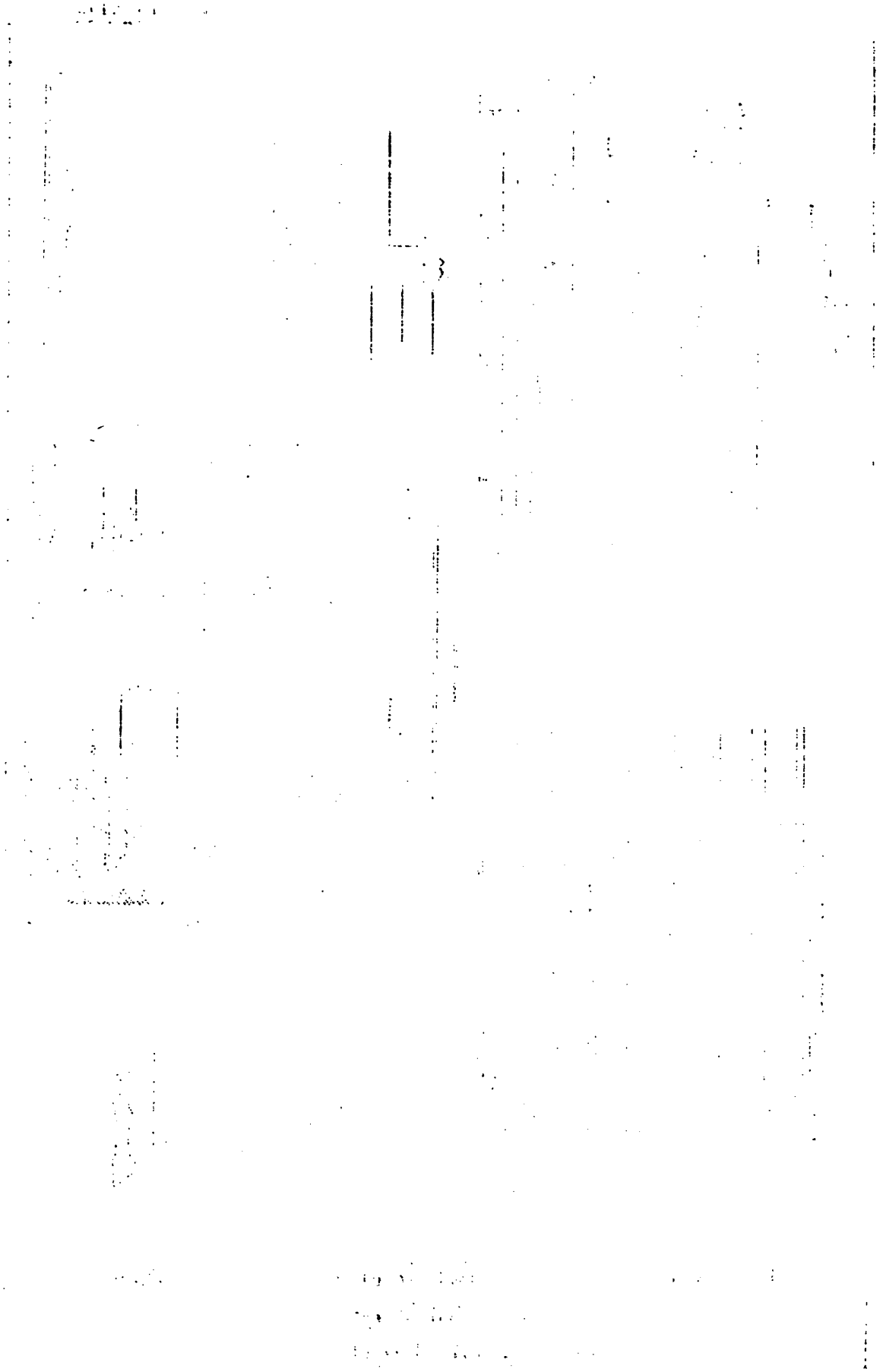


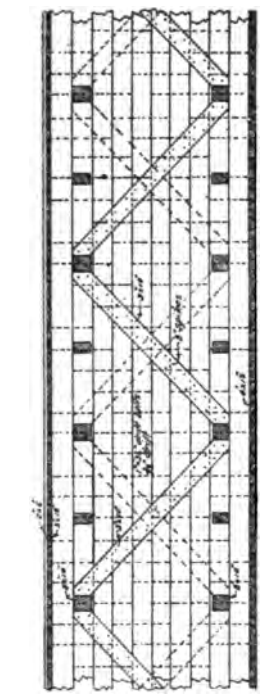


CONSTRUCTION DIVISION OF THE ARMY
PLAN AND ELEVATION OF
STANDARD COVERED LIGHTERS

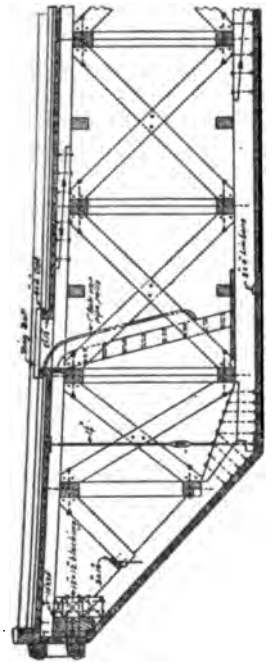
SECTION THRU HOUSE ON COVERED LIGHTER
SECTION SHOWING ROLLERS UNDER DOORS
DETAIL OF TRACK UNDER DOORS
SECTION OF DOOR OPENING
DECK FRAMING PLAN BOTH FORE & AFT
DETAIL OF HULL FASTENINGS
DETAIL SHOWING BOLLARD FASTENING

CONSTRUCTION DIVISION OF THE ARMY
DETAILS OF
STANDARD LIGHTERS

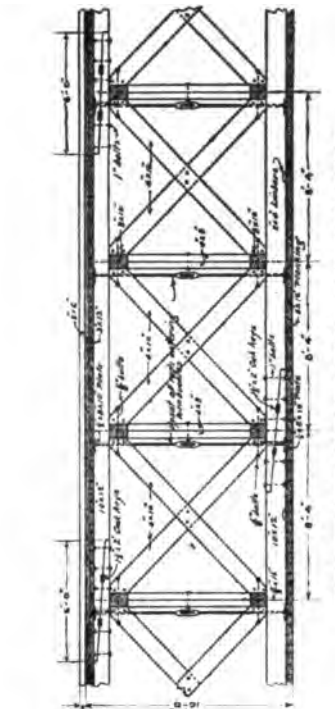




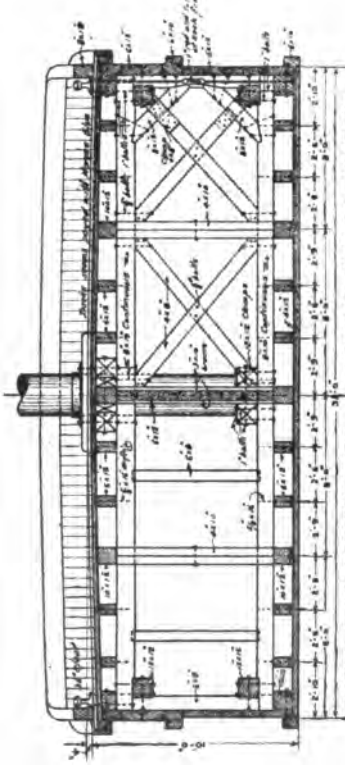
SECTION OF LONGITUDINAL BULKHEAD



TRUSS FRAMING BOTH FORE AND AFT

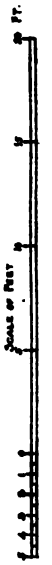


INTERMEDIATE SECTION OF LONGITUDINAL TRUSS



SECTION THRU TRANSVERSE FRAMES

SECTION THRU INTERMEDIATE FRAMES



SCALE OF FEET

CONSTRUCTION DIVISION OF THE ARMY
DETAILS OF
STANDARD LIGHTERS

DESIGN AND MATERIALS.

In selecting materials for temporary buildings, it should be kept in mind that the salvage value of such materials, or of completed buildings, is low as compared with their usual cost under emergency conditions.

Temporary, one-story warehouses should be constructed with brick, concrete or hollow tile exterior walls; brick fire-walls; concrete or wood floors; wood roof-framing and supports; pitch or asphalt composition built-up roof-covering; see Plate No.'s 105 and 106. Open sheds should have similar construction, omitting the exterior walls and if permissible, omitting wood or concrete floors; see Plate No. 107.

Temporary warehouses should be divided into sections by brick firewalls, extending through the roof; see Plate No. 105. The undivided area should be kept within 15,000 square feet, although in many of the buildings built, where special consideration was given to other features of fire protection, this limit has been exceeded. Sheds should be similarly sub-divided, if used for the storage of inflammable materials.

Metal ventilators should be provided for warehouses. Wood or metal skylights furnished with wire-glass, are preferred to windows for lighting; see Plate No. 111. Both sides of openings in fire-walls, should be equipped with approved Underwriters' automatic fire-doors, see Plate No. 109.

It has been considered advisable to install the dry sprinkler system throughout warehouses, locating the dry valves in pits electrically heated; see Plate No. 110. By this arrangement, it is possible to omit heating or to heat the units as the character of goods stored in them may require.

The necessity for saving steel, is an important factor in designing emergency construction; therefore, in warehouses, it has been limited to such structural features as absolutely require its use. In permanent construction, reinforced concrete has been installed in order to avoid the use of structural steel shapes.

In congested districts, such as the cities of New York, Philadelphia or Chicago, there have been provided permanent multi-storied warehouses, terminals and piers. The warehouse group at Chicago, as typical of this construction, is shown on Plate No. 113.

FUEL OIL AND GASOLINE TANKS.

CAPACITIES AND CONSTRUCTION.

Tanks for the storage of gasoline and oils may be successfully constructed of reinforced concrete, when the use of iron and steel for such purposes is restricted.

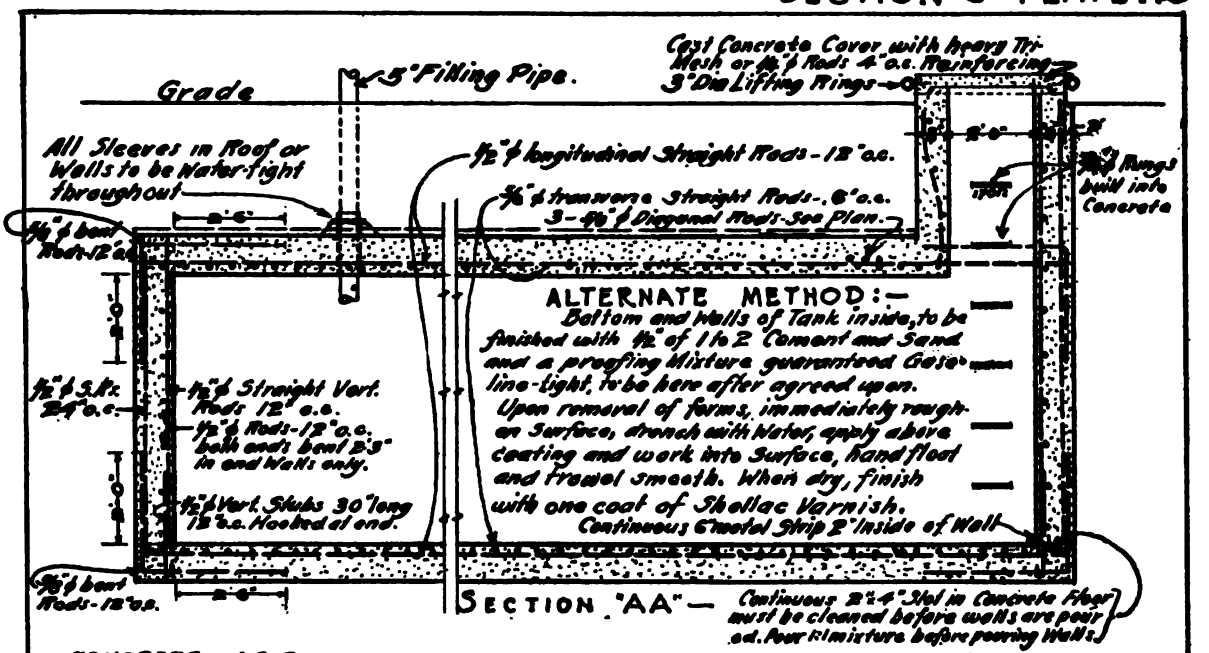
Drawings are available for standard concrete tanks for storage of oil or gasoline, in the files of the Construction Division, as follows:

Drawing No.	Gallon Capacity	Inside Diameter	Height Inside
610-300	12,000		
6463-110	200,000	43 feet 6 inches	18 feet 6 inches
6462-111	250,000	50 feet	17 feet 6 inches
6429-110	300,000	60 feet	14 feet 6 inches
6296-110	500,000	73 feet	16 feet
6462-110	750,000	80 feet	20 feet 4 inches

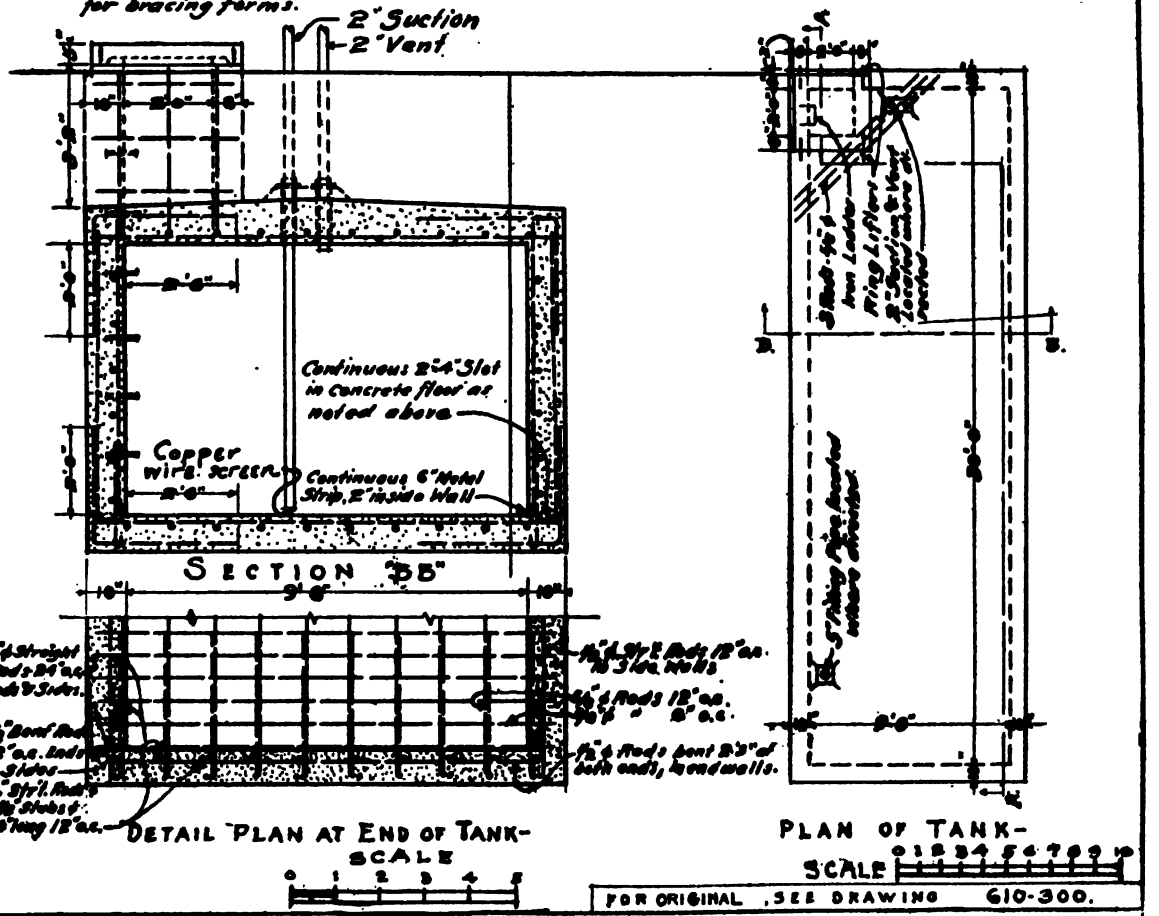
Concrete used for tanks should consist of one part cement, two parts sand, three parts broken stone or gravel, and 10 lbs. of hydrated lime for every 100 lbs. of cement used. Crushed stone or gravel used, should be such as will pass a 1-inch ring. The materials should be mixed together in a batch mixer, *at least 2 minutes,* after all the ingredients are in the mixer. The concrete mixture should be of such consistency, as will flow sluggishly into the forms and such as can be conveyed from the mixer to the forms, without separation of the coarse aggregates from the mortar. While being deposited in the forms, it should be well compacted with a straight shovel or slicing tool. After the process of pouring concrete is begun, it must proceed as rapidly as possible, thus reducing the number of laitance seams. Where it is necessary to bond new concrete to old, the old concrete must be thoroughly cleaned, roughed, drenched with water, and then slushed with a mortar consisting of one part cement and one part sand. The entire bottom of the tank must be troweled perfectly smooth. The interior surfaces of the side walls and the surfaces of all the columns should be made smooth, by careful and continued use of the slicing tool, during the process of placing the concrete. Any rough spots which show after the forms are removed from the interior, should be made smooth by mortar applied with a trowel. Forms should be of dressed and matched lumber and carefully joined to insure smooth surfaces. Forms should be left in place at least seven days.

Note: All of the above applies to tanks for the storage of fuel oil only. If gasoline is to be stored, the following additional instructions apply:

When thoroughly dry, the entire interior surface of the bottom, side walls, and columns, should be sprayed with a coat of the best "long-oil" spar varnish thinned with 20 per cent volatile mineral spirits and applied under a pressure of 60 lbs. per sq. in. by a paint gun. After this coat has dried for a period of at least 24 hours, it should be followed by two more coats, separated by an interval of not less than 48 hours, using pure undiluted spar varnish and applied in the same manner. Each varnish coating should be put on in such a thickness, that one gallon will cover approximately 200 sq. ft. The volatile mineral spirits should be a hydrocarbon dis-


Cast Concrete Cover with heavy Tri-Mesh or ½" ϕ Rods 4" o.c. Reinforcing
3" Dia Lifting Rings
Grade
3" Filling Pipe.
All Sleeves in Roof or Walls to be Water-tight throughout
½" ϕ longitudinal Straight Rods - 12" o.c.
⅝" ϕ transverse Straight Rods - 6" o.c.
3 - ⅝" ϕ Diagonal Rods - See Plan.
⅝" ϕ Rings built into Concrete
⅝" ϕ bent Rods - 12" o.c.
ALTERNATE METHOD:—
Bottom and Walls of Tank inside, to be finished with ½" of 1 to 2 Cement and Sand and a proofing Mixture guaranteed Gasoline-tight, to be here after agreed upon.
Upon removal of forms, immediately roughen Surface, drench with Water, apply above coating and work into Surface, hand float and trowel smooth. When dry, finish with one coat of Shellac Varnish.
½" ϕ Straight Vert. Rods 12" o.c.
½" ϕ Rods - 12" o.c. both ends bent 2'3" in end Walls only.
½" ϕ Vert. Stubs 30" long 12" o.c. Hooked at end.
Continuous 6" Metal Strip 2" inside of Wall
⅝" ϕ bent Rods - 12" o.c.
SECTION "AA"—
Continuous 2"x4" Slot in Concrete Floor must be cleaned before walls are poured. Pour this mixture before pouring Walls.

CONCRETE :- 1-2-3 mixture- aggregate, clean crushed stone or gravel, to pass 1" ring. Concrete to be well worked around reinforcement. If possible, Pour in one operation. Other wise floor must be poured in one continuous operation, and Walls in another. Use no wire for bracing forms.


2" Suction
2" Vent
Continuous 2"x4" Slot in Concrete floor as noted above
Copper wire screen
Continuous 6" Metal Strip, 2" inside Wall
SECTION "BB"
½" ϕ Straight Rods 24" o.c. Ends 9" Under
½" Bent Rods 12" o.c. Ends in Sides
½" Str'l. Rods & ½" Stubs 30" long 12" o.c.
½" ϕ Str. E Rods 12" o.c. in Side Walls
½" ϕ Rods 12" o.c. 8" o.c.
½" ϕ Rods bent 2'3" at both ends, Headwalls.
DETAIL PLAN AT END OF TANK-
SCALE
0 1 2 3 4 5
PLAN OF TANK-
SCALE
0 1 2 3 4 5 6 7 8 9 10

FOR ORIGINAL, SEE DRAWING 610-300.

CONSTRUCTION DIVISION OF THE ARMY
CONCRETE GASOLINE OR OIL TANK
CAPACITY 12,000 GALLONS

tilate, water white, neutral, clear and free from water. It should have no darkening effect when mixed with basic carbonate white lead. The varnish should comply with the War Department Specification No. 6, with particular attention to the water tests.

As an alternate to the instructions of the preceding paragraph, it may be deemed advisable in some cases to use one of the proprietary proofing methods of the market, but, only on condition that the concern awarded the contract, shall furnish an acceptable surety bond guaranteeing the construction to be proof against leakage for a given period of years.

ELECTRIC POWER AND ILLUMINATION.

STANDARDS FOR ELECTRICAL CONSTRUCTION.

GENERAL.

PRELIMINARY NOTE:

These instructions are not to be considered as adequate specifications, for materials to be furnished or for work to be done, under the lump sum contract. They are intended to serve in connection with the emergency form of contract, which was adopted to enable work in the field to proceed immediately, without the necessity of waiting for detailed drawings. Detailed specifications, for use in connection with lump sum contracts, may be obtained by application to the Washington Office.

SUPPLY OF ENERGY:

It is the established policy of the Division to obtain electrical energy, for all enterprises, from existing sources as far as available and consistent with economy and with military necessities. The utilization of existing power plant equipment thus makes light and power quickly available for construction purposes, with an accompanying conservation of fuel and labor in operation; and in general, results in economy as compared with the installation and operation of an isolated plant.

However, in certain cases it will be necessary to install a generating plant on the premises, as where small amounts of power are required remote from existing facilities, or where military policies require a project to be self-contained.

In some cases where steam heating will be required, it may be desirable to install generating equipment to operate during the heating season, and exhaust into the heating system, purchasing power on an off peak basis at other times. A careful investigation should be made before deciding on such an installation, as it may not result in economy where the electrical demands may exceed the steam requirements. In making a study of the relative costs, full consideration should be given to the greater investment required in building, high pressure boilers, piping, boiler room auxiliaries, low pressure steam mains and fittings, in addition to the cost of generating equipment itself.

For camps and cantonments it has been found that the average monthly load factor is approximately 35-40 per cent; the winter demand for lighting only, 25-30 watts per capita; and for lighting and power, 35-40 watts per capita. For tent camps, the demand is 50 to 60 per cent of the above. For Hospitals, the demand is approximately 80 watts per bed for lighting only, and 100 watts per bed for lighting and power.

In general, all power distribution should be alternating current. Where direct current is required for speed control, it should be obtained through the use of rotary converters, where the demand will be 100 K. W. or greater, and by motor-generator sets or rotary converters for smaller installations.

The Constructing Officer should report to the Washington office, as to the ability of the power companies adjacent to the job to furnish the estimated requirements, both during the construction period and for operation; supplying them with an estimate of the approximate amounts of power required at various dates until the project is in full operation. Should none of the companies be able to supply the entire energy required, on account of location or lack of generating or transmission line capacity, the fact, with complete details, should be reported to the Washington office.

As a matter of economy, the entire supply should be furnished by one company, but in very important projects, duplicate supply lines or an emergency tie to another source of supply may be desirable. In practically all large projects, a decision as to the source of supply and the preliminary negotiations as to terms and conditions, will have been undertaken before construction forces are in the field and consequently when the Constructing Officer is assigned to a job, he should at once acquaint himself with the status of the negotiations.

It is generally advisable that the Constructing Officer avail himself of the advice of the Electrical Section, as to the best form of rate schedule applicable to cases involving the purchase of permanent power supply of over approximately 50 KW and also as to other conditions under which service will be furnished.

EXTENSION OF TRANSMISSION LINES:

In some cases it may be necessary for the Government to construct an extension to the existing high tension transmission line of the Power Company to reach the project. In general, the details of construction of such transmission line extension and transformation facilities, if necessary, should be in accord with the power company's standards, so that there can be no question as to the suitability of the equipment for operation on the company's system, and so that it might readily be taken over by the company as an integral part of its system at a later date.

MATERIALS AND APPARATUS; INSTALLATION:

All material and apparatus used in the equipment of the project itself should, so far as possible, be that described in the "Army Catalogue of Electrical Apparatus and Supplies" and also conform to the current and applicable standardization rules of the "American Institute of Electrical Engineers," the "National Electric-Light Association," the "National Board of Fire Underwriters" and the "National Electrical Safety Code," with such modifications as are specified herein, or as good engineering may prescribe, with due consideration of the uses and permanency of the undertaking.

All reasonable laws and ordinances of the locality and service rules of the service company and public utility commission having jurisdiction should be observed.

SUBSTATIONS:

Sub-stations should be of the out-door type; that is, with transformers, high tension bus, and protective apparatus located out of doors, and with wiring supported on skeleton framework, which may be wood, steel or reinforced concrete as determined by the character of the project. See Plate No. 119.

In large projects a primary feeder switchboard should be installed as a part of the substation equipment which should be housed in a suitable building with concrete floor and with brick, tile or concrete walls, or of sheet iron for temporary construction. Distribution feeder panels should be plain finished slate, on pipe or angle-iron frame, each with ammeter, an ammeter-switch

and automatic hand-operated oil circuit-breaker, with adjustable time limit overload trip, and a single set of current transformers for ammeters and circuit-breaker trip coils. Calobrating terminals should be provided for readily connecting portable watt hour meters if desired. Each switchboard should be equipped with a volt meter on swinging bracket and 200 watt potential transformer, volt meter receptacle and plug for measuring voltages on all phases.

If an attendant is not to be on duty at all times at the substation, a curve drawing volt meter of the circular chart type should be installed and connected to the main bus. If the power contract does not provide for the measurement of the maximum demand by the power company, a demand meter arranged for a 15-minute time interval should be provided by the Government and connected to the main bus. Suitable space on panels, or otherwise, as required in the wiring scheme, should be provided for metering equipment to be installed by the power company.

In some instances where the service is taken direct from a main transmission line, the voltage regulation may not be sufficiently close for satisfactory lighting. In such cases automatic regulators should be installed to regulate the lighting feeders, splitting the main bus between the lighting and the power feeders. In large projects, it will often be economical to provide regulators in the individual lighting feeders, serving sections remote from the substation, rather than install sufficient copper for satisfactory regulation. For long feeders of small capacity, pole type regulators are satisfactory. The substation building and wiring should be laid out so that regulators can be installed, even though the immediate requirements do not warrant their use. Regulators on important feeders should be so installed, as to be readily disconnected by interrupting the service only momentarily.

In general, the recommendations of the service company should be followed in the choice of protective equipment for the high tension side of the substation. For 13,200 volts or over, electrolytic or oxide film lightning arresters should be used. The choice of oil circuit-breakers or horn gap switches and fuses, should be governed by the relative cost and the importance of maintaining service under adverse conditions, as well as the characteristics of the system to which they will be connected. Care should be exercised to provide protective apparatus of sufficient interrupting capacity.

GENERATING PLANTS:

The type of prime mover to be used will depend on the size and character of the plant, the class of fuel available, the uses for the waste heat and the character and quantity of water supply. No definite statement can be made as to the limitations of each type, or as to the sizes of the units without a detailed study of each project. In coast defense or similar projects, internal combustion units should be used, on account of the elimination of chimneys and smoke.

The electrical characteristics of the plant should in general follow the principles outlined under "Substations." Energy should be generated at the distribution voltage.

OUTSIDE WIRING.

PRIMARY DISTRIBUTION:

In projects where there are a number of buildings in scattered groups, or single buildings covering large areas, a primary distribution system, preferably three phase, should be used obtaining energy directly from the power company's line, where the potential does not exceed 6,600 volts. If the primary supply is of a higher voltage, a transformer substation will be erected by the Government; or by the company, if the contract is made for energy at a lower voltage.

The primary distribution system from transformer substation should be 3-wire 3-phase 2,300-volt; except for a system serving exceptionally large camps, or a large group of widely scattered activities with relatively large demands, in which cases, a 4-wire 3-phase system, 4,000/2,300 volts, is desirable using standard 2,300 volt distributing transformers with neutral grounded at the substation only.

For best regulation, transformers should not be connected to long feeders at points near the substation. The total area to be served by the system should be roughly divided into zones, each to be served by a separate feeder, the number of feeders being governed by the load and the character of the project. Branches feeding relatively small amounts of lighting load only should be single phase, but so installed that they can readily be converted to three-phase. They should be so connected as to balance the load on the three-phase feeders. Both single and three-phase branches should be provided with means of ready disconnection, such as disconnecting pot heads, at points where main feeder is tapped; providing such branches would introduce a real hazard if kept alive during a fire or other emergency, and it is essential to maintain service to other sections of the undertaking served by the same feeder.

Branches of feeders serving specially important utilities, such as pumps and protective lighting around ordnance depots, should be so arranged as to connect to feeders at separate points, providing such arrangement does not result in unwarranted excess in copper. Disconnecting pot heads with dummy caps and tubes should be provided at each point of connection.

Large power loads not widely scattered should be served by a separate power feeder.

SECONDARY DISTRIBUTION:

Secondary mains and services from distributing transformers to lighting panels or cutouts in various buildings should be 230/115 volt, 3-wire single phase; excepting when there are 4 or less circuits within any building, then the services should be 115 volt, 2-wire.

Secondary power services for installations of more than 2 horsepower should be 230 volt, 3-wire, 3-phase; excepting that 460 volts may be used for large installations, where 2,300 volts is undesirable. Certain large power installations as hereinafter described may be 2,300 volts. Power services for less than 2 horsepower should be 230 volt single phase.

Ordinarily, the use of larger conductors than No. 4/0 B & S in open wiring or 500,000 C. M. in conduit, is not economical with 60 cycle current and the voltage of the system should be chosen and layouts planned with this in view.

Secondary mains should not be interconnected, except where economy in copper or other consideration makes interconnection desirable. In such cases, the connection should be made through a suitable pole mounted weatherproof cutout, fused at 50 per cent of the rated capacity of the smallest transformer interconnected.

Secondary distribution for tent camps shall consist of 6-inch 20-foot poles, spaced approximately 50 feet on centers, the conductors being carried on racks. No more than 18 lamps should be connected to any branch circuit. Porcelain cutouts with plug fuses should be mounted in steel box on pole, with all wires entering box from below. For typical tent camp distribution see Plate No. 122.

POLE LINES:

Poles, for general line use should be 30 feet long and 7 inches in diameter at top, for one or two-line arms; and 35 feet long and 7 inches in diameter at top, for three or four line arms.

For light and power line poles used jointly for telephone or other signal wires, see Signal Corps Specifications No. 601 included in this Manual and Plate No.'s 130 and 131.

All poles at corners, dead ends, curves, railroad crossings, and those supporting transformers to be N. E. L. A. Class "B" or heavier, others not carrying signal lines may be "woods run."

Poles for cantonments and other semi-permanent construction, are to be untreated, excepting that roofs and gains should be painted.

Standard span lengths should be 100 to 125 feet but no span should exceed 140 feet.

Each pole should be roofed, gained and bored before being set. Gains to be ½ inch in depth, 4½ inches in width, spaced 24 inches on centers, the first gain being 10 inches from tip of roof. Necessary buck arm gains are to be cut 12 inches below the line gains.

Corner, junction and dead end poles should be set with a rake of 12 inches at the top after the strain has been applied and single poles carrying transformers with a rake of 8 inches to 12 inches.

All poles carrying branch cutouts, street or protective lamps which can be reached from pole, switches, arresters and transformers should be stepped, spaced 18 inches between centers, extending from a point 4 feet from top of pole to a point approximately 10 feet above ground. Steps should project 5 inches from pole, located in line with lead.

Cross Arms, Hardware and Fittings: Double cross-arms should be installed at dead ends. curves, junctions and corners. These arms should be fastened together at the outer ends by means of space bolts. All bolts should have washers to prevent bolt-heads and nuts bearing directly on wooden surfaces.

Insulator pins should be locust, secured in arms by 8-penny nails; and all arms are to be completely pinned. Insulators placed on pins are to be for immediate use only. Brackets may be standard metal, two-point or three-point.

Guys and Anchors: Guys should be set at all dead ends, corners and places of unbalanced strain, using patent anchors, except in marshy ground, where "deadman" anchors should be used.

Guy cable should be galvanized standard steel strand, attached with iron pole collar or shins, with guy hooks, where on cedar poles. Strain insulators and ground clearances are to be as per Signal Corps Specifications No. 601, included in this Manual.

Where necessary for protection, guys are to be covered at ground with a 10-foot length of 1¼-inch galvanized pipe plugged at the upper end.

Wire: All line wire, except as hereinafter mentioned, should be bare medium hard drawn copper, in even sizes up to No. 1 B & S. Sizes No. 2 B & S and larger are to be stranded; smaller sizes are to be solid.

The minimum size for service connections and series fence lighting circuits with spans not over 75 feet should be No. 8 B & S and for other lines, No. 6 B & S.

Splices must not occur over railroad or street crossings.

Sleeves should be used for splicing all wires.

Siemens Martin steel strand may be used for series lighting conductor where the circuits are short. The 5/16-inch strand has a resistance of about 7.1 ohms and an internal reactance of about 0.3 ohms per mile at 6.6 amps.

Wire Positions: Primary wires must be placed above secondary wires, if on separate arms, and the two classes should, as far as possible, be placed on separate arms.

Series circuit wires should be located on pole pins, lowest arm. The neutral of four-wire three-phase systems should be on a pole pin on the same arm as the phase wires.

Lightning Arresters, should be installed on the primary lines for the protection of, and on the same pole with, all transformers. Arresters should also be installed on the same or next adjacent pole to all cable terminals, primary line entrances and at other points where there would otherwise be an exposed primary circuit of over 2,000 feet.

For constant current circuits, arresters adapted to such service should be used.

For 4-wire, 3-phase circuits, a plain 300 volt-gap arrester should be used for the neutral wire, with standard phase arresters for the three-phase wires.

GROUNDING:

The neutral wire of all single-phase 230/115 volt secondaries, one side of all two-wire 115 volt secondaries and the middle point of one transformer on all three-phase 230-volt secondary installations shall be grounded, at transformers. Three-phase 460 volt secondaries should be grounded through one 300-volt gap arrester connected to the middle point of one transformer.

Ground connections may be made by driving 10-foot pieces of ¾-inch galvanized pipe into the ground, the pipe to be fitted with point and cap; and when driven, salt should be sprinkled on the ground at the top of the pipe and thoroughly moistened.

The ground wire should be rubber-covered No. 6 B & S copper, attached to pole only at ends and covered with wooden moulding on pole and along cross-arm.

Grounds on lighting and power secondariesshould be kept separate, except where taken from the same transformer bank.

Lightning arrester ground connections must be separate and apart from all other ground connections. Where more than one ground is installed on the same pole, they must be placed on opposite sides of the pole. Secondaries over 500 feet in length should have two grounds on separate poles.

TRANSFORMERS:

Distributing Transformers, for power and lighting should be standard pole type, oil insulated, self-cooled, single-phase, installed with primary fused cutouts. In camps and similar installations where all of the lamps connected to a transformer are liable to be used at one time, the individual lighting transformer capacity should be approximately 90 per cent of the connected load. For power installations, transformer capacity in KVA should be 80 per cent of the maximum total horsepower of motors which will be in operation at one time, except installations of less than 3 motors, or for pumping stations and refrigerating plants in which cases it should be 100 per cent. In specifying transformer sizes, consideration should be given to any increase in load which will probably occur in the near future.

In power installations where the total transformers rating is under 20 KW, two transformers should be installed, connected in open delta. In specifying transformers to be so connected, it should be observed that the capacity of the bank is approximately 85 per cent of the combined rating.

Transformers should be mounted as follows:

Maximum Sizes on 1 Pole Class "A"	Maximum Sizes on 2 Pole Structure, Class "A"
1-50 KVA	2-50
2-25 KVA	3-37.5
3-10 KVA	Larger sizes to be mounted on ground

Note: Class "B" poles may be used for next smaller size transformers.

Single transformers of 5 KVA and smaller should be hung from double line arms. Larger sizes, and all installations of more than one transformer on a single pole should be hung from double arms spaced not less than 24 inches below the primary line arm.

Primary transformer fuses for 2,300 volts should be as follows:

(a) Single phase, 1.0 ampere per KW up to and including 10 KVA.

(b) Single phase, 0.8 ampere per KW above 10 KVA.

(c) Open delta, outside leads as per (a) and (b); middle lead, next larger size.

In open delta installations on 4-wire 3-phase system, the neutral cutout shall not be fused but connected through with copper wire. See Plate No. 120.

(d) Closed delta, all leads 1.75 of (a) and (b).

Cutouts for three-phase transformer banks should be in the line taps and not in the individual transformer leads.

Porcelain primary cutouts should be used on outdoor transformer installation of single units, 50 KW or less and for banks of 100 KW, or less. Larger installations should be protected by expulsion fuse cutouts.

Transformer secondary leads should not be fused.

Constant current transformers, up to and including 10 KW should be stationary coil, pole type controlled by rope operated pole type primary oil switch. Larger size transformers are to be moving coil, station type.

STREET LIGHTING:

Street lighting should be by means of 100 c.p., 6.6 amp. type "C" units, on series circuits, using film cutout sockets, gooseneck brackets, and 18-inch radial flat street hood bodies, spaced at corners and on approximately 200-foot centers, mounted 20 feet from ground and on alternate distribution line poles where available. At corners, fixtures should be directed toward the center of the roadway intersection. Street lighting fixtures are not to be located on poles with transformers, if it can readily be avoided.

Circuit voltage should not exceed 2,500.

PROTECTIVE LIGHTING:

The former standard protective fence lighting practice consisted of 600 c.p., 6.6 amp., type "C" series lamps in flood light projectors facing in one direction, parallel to fence line and spaced approximately 500 feet, mounted 12 feet from ground, employing line insulating transformers and mogul base series sockets. The present standard consists of 100 c.p., 6.6 amp., type "C" series lamps in film cutout series sockets in porcelain enameled steel angle reflector sockets; spaced 56 feet, facing at right angles to fence, mounted 12 feet from ground on 45 degrees gooseneck attached to extension of fence post, with alternate lamps on two separate circuits, having wires supported by transposition insulators mounted on 2-point brackets attached to fence post. The reflectors should be so adjusted that no light is thrown on the fence itself. See Plate No. 119.

Railroad or other yard lighting can best be provided by flood light projectors in batteries mounted on pole or tower structure or on buildings at sufficient height to avoid objectionable glare. Sixty to seventy feet mounting height is desirable.

UNDERGROUND CONSTRUCTION:

Primary or series circuits which must cross parade or drill grounds, balloon or aviation fields, should be multiple conductor paper insulated lead covered steel armored cable laid directly in the ground and terminated in suitable pot heads below line arm on the terminal poles.

Underground construction may also be used for fortifications and large permanent warehouse or terminal projects, but not for general distribution in camps and army posts. Where so used, either an underground duct system with lead covered cables in conduit or steel armored cables laid directly in the ground may be installed, as the individual circumstances may warrant.

ALLOWABLE VOLTAGE DROP:

The per cent drop based on delivered voltage to the point of delivery and also based on the estimated maximum demand should not ordinarily exceed values given in the following table:

Class Wiring	Light	Power
Building	2	3
Service	1½	*2
Secondary Mains	2	*3
Primary Mains	2	*3
Primary Feeders	5	7
Primary Feeders (regulated)	10	10

*In special cases where the feeders are closely regulated, these values may be increased 50 per cent, but care should be taken that proper voltage is obtainable to provide sufficient starting torque for all motors.

INTERIOR WIRING.

GENERAL:

A fused service switch of ample capacity to carry the full connected load should be installed in each building at the nearest convenient point to the service entrance, except as mentioned herein below.

All power services over 250 volts or 200 amperes and lighting services over 500 amperes capacity should be protected by circuit breakers in place of fuses. Circuit breakers on power circuits should be provided with inverse time limit trip. If circuit breakers non-closable on overload are installed, switches for circuit control may be omitted.

All polyphase motors over 5 HP which are not subject to constant supervision while in operation should have means for prevention of operation on single phase.

In cases where motors of 30 horsepower or larger are installed where accessible only to competent employees, the motor circuits generally should be for the primary distribution voltage where this does not exceed 2,300 volts. Service mains should be provided with disconnecting type fuses, choke coils and lightning arresters on pole, and disconnecting switches and an oil cir-

cuit breaker with time limit trip in the building. Each individual motor circuit should also be equipped with disconnecting switch and auto starter or starting panel with time limit adjustable overload and undervoltage release. Wiring on fire-proof walls or pipe supports may be open type; in other cases, should be multiple conductor lead sheath cable in conduit.

In 230-volt alternating current power installations with a small amount of incidental lighting, the lights may be fed from power transformer bank by bringing out middle tap of one transformer secondary and using the same as neutral. See Plate No. 120. In this case, the transformer thus tapped may be of larger capacity to take care of the increased load due to lighting.

In each case where a service is carried along the outside of a building the leads should be rubber-covered and carried under the eaves and supported on metal service brackets and racks in a manner to afford as full a protection to the wires from the action of the elements as possible.

No sockets, reflectors, motors, or appliances should be installed or connected until all lighting circuits have been properly poled up and tested, and all grounds and short circuits removed.

Wire shall be run continuous without joints as far as practicable, from cutouts to the last outlet on each circuit. Single conductors No. 6 B & S gauge and larger shall be stranded.

Each distributing center, service switch or circuit breaker should be enclosed in a steel cabinet. Fused mains and branches of a capacity up to and including 30 amperes on lighting circuit should be plug-fused, all others cartridge fused. All fuses on power circuits should be cartridge type.

All branch lighting circuits should be 115 volt 2-wire. There should be not to exceed 16 sockets on any one lighting circuit, regardless of the total wattage of the circuit.

Watt-hour meters should be installed in services supplying water and sewage pumping stations, refrigerating plants, laundries, reclamation plants, and camp community projects. Current supplied all "non-issue" projects must be metered, the meters furnished by the individual consumer. All permanent army post buildings should be provided with watt-hour meters.

The following tabulation of general illuminating intensity values, expressed in watts per square foot of floor area, is intended as a guide for preparing layouts:

Name of Building	Watts per Sq. Ft.
Camps and Cantonments.	
Storehouses	.20
Barracks	.25
Fire Stations, Infirmaries, Mess Halls	.30
Shops, Motor Repair and Ordnance Repair	.30
Class Rooms, Officers' Quarters & Exchanges	.50
Hospital Buildings.	
Wards	.25
Laboratory, Nurses' Quarters	.40
Miscellaneous Buildings.	
Port Terminal Warehouse	.25
Shops, Mechanical Repair Unit	.75

INSTALLATIONS:

Knob and Tube and Cleat: Service mains for all knob and tube and cleat wiring systems should be installed, as shown on Drawing No. 620-367, in the files of the Construction Division.

Wires of No. 10 B & S gauge or smaller, should be secured by 2-wire porcelain cleats or porcelain knobs and bushings; larger conductors by single cleats. All wire supports should be spaced not more than 4 feet on centers.

Strain insulators of approved style and size with turn-buckles or "take-up" eye bolts should be installed at the ends of all straight runs 50 feet or longer where wire is No. 4 B & S or larger.

In the case of installation of switches and wall receptacles on all cleat wiring work, the wires on the wall from ceiling to outlet should be installed in conduit with suitable threaded conduit fittings.

On all knob and tube work in lath and plaster buildings where fixtures or switches are installed, outlet boxes should be used.

Branch cutouts should be porcelain and securely mounted to back of cabinet with stove bolts.

All cleats, surface receptacles and switches, and rosettes should be secured by round head blued wood screws. Ceiling and wall receptacles, rosettes and switches should be porcelain types adapted to the particular method of wiring indicated on plans.

Rigid Conduit: In all conduit wiring systems the service should terminate in a service conduit fitting.

Conduit should in general be enameled steel, although galvanzed steel should be installed in cases where exposed to excessive moisture or subject to mechanical injury.

Conduit where run exposed on ceiling, should be installed in straight lines parallel to the building walls and securely supported by clamps, hangers, or racks. All breaks around protruding beams, girders, etc., should be made with conduit fittings equipped with blank covers.

No junction or pull-box should be installed in an inaccessible location and all junction and pull-box covers should be made removable. All outlets should be equipped with metal boxes or fittings. When knockout boxes are used, they should be securely supported and fastened with a locknut outside and a bushing inside each conduit entrance. In all buildings where conduit is run exposed, threaded fittings should be used at all outlets.

All unused outlets should be covered with suitable blank covers.

The conduit system in each building should be properly grounded to a cold water pipe or other approved ground by means of a ground clamp, or in cases where wood water mains are installed, an independent ground should be provided as described under "Grounding."

Metal moulding may be used where conditions demand, in which case specially adapted fittings must be used.

PERMANENT ARMY POSTS:

In general for all frame buildings, or buildings with frame studding and joists, concealed knob and tube, or cleat wiring should be installed.

In buildings with fire-proof walls, partitions and floors, wiring must be installed in rigid steel conduit.

CAMPS AND CANTONMENTS:

In general, the standard for all receptacles, sockets, rosettes, etc., for inside wiring in camps and cantonments will be porcelain. Reflectors will be steel paint enameled, except that porcelain enamel should be used where exposed to the weather or excessive moisture.

Frame structures, including those with fire walls, such as barracks, mess halls, etc., except as modified herein, should be wired open cleat style, which is the accepted standard for inside electrical wiring in camps and cantonments.

All wiring for ranges in kitchens should be done with slow-burning wire in rigid conduit, and outlets should be equipped with threaded fittings.

Wiring for refrigerator lighting must be installed in conduit, using marine or vapor-proof globes and fittings for lighting outlets, inside coolers, and threaded fittings outside. Details of refrigerator wiring, including pilot receptacles connected in series with switch, should be as shown on Drawing No. 620-367, in the files of the Construction Division.

Garages, storehouses, laundries, theatres and lecture halls, magazines, and gas instruction buildings, must be wired in rigid steel conduit run exposed.

THEATRES:

Liberty Theatres should be wired as indicated on Drawings No. 620-522, in the files of the Construction Division. Wiring for sign on front of building should be run open cleat style. Border lights should be furnished and installed with white, red and blue lights, wired alternately, white and color. Each circuit should extend the full length of the border. Borders should be constructed and arranged for feeding from right hand ends, facing house and should be completely rigged and suspended in an approved manner to permit of lowering to within 10 feet of stage level. Borders should be wired with slow burning wire and fed by flexible border cable, six conductor, No. 12 B & S gauge. Each border should be fed with 3 circuits which should run from their respective switches on the stage switchboard, to a suitable steel box with bushed cover, located at a convenient point on the fly gallery, where the border cables should be spliced in.

Footlight trough should be furnished with white, red and blue lights, wiring alternating white and color. Connection to footlight trough should be made at right hand end facing house. Single section stage pockets, 2 wire 50 ampere capacity complete with plugs, should be installed on each stage flush with stage floor, on each side of stage.

An emergency lighting system, entirely separate and distinct from the general lighting system should be installed. Service cabinet for emergency lighting system, should be supplied through separate transformer and should be equipped with panel fused main switch and plug fused branch circuit with push button switches.

Picture machine booth cutout cabinet should have 3/2 wire panel, 4-circuits, with main lugs and 60 amp. fused knife switches in branches.

Each theatre should be equipped with a stage switchboard complete with all necessary fuses and connections. Theatre dimmer should be two-wire, normal duty type, with not less than 110 steps. Dimmers should be mounted complete with racks above the stage switchboard and control should be manual by individual and master levers.

A four-station intercommunicating telephone system should be installed in each Liberty Theatre building, complete with battery of dry cells. Wiring should be of 8-conductor cotton

telephone cable covered with substantial moisture resisting braid, cable to be exposed. Telephone sets may be surface mounting, equipped with watch-case type receivers and arranged for selective ringing, common talking service.

MISCELLANEOUS BUILDINGS:

The scheme for lighting garages, boiler houses, refrigerating plants, laundries, etc., should be rows of ceiling receptacles with steel reflectors for general illumination, drop cords over work benches, and plug receptacles conveniently located for the attachment of extension cords. Exterior reflector sockets may be installed over doors where required for outside illumination.

HOSPITALS:

General: The general wiring method for frame hospital buildings should be concealed knob and tube, and for buildings with fireproof walls, concealed rigid conduit.

Ceiling receptacles and sockets may be brass shell, and in general lighting reflectors should be glass except in kitchens, where porcelain or paint enameled steel reflectors should be installed.

All outlets in tile or masonry walls in frame buildings should be installed with concealed conduit wiring, outlets equipped with flush mounting steel boxes and covers with flush mounting receptacles and switches and brass plates with brush brass finish.

In general all wards, quiet rooms, etc., should be lighted by pull ceiling receptacles and wall receptacles should be installed in wards and quiet room for portable electrical apparatus.

Outlets for heating appliances in utility rooms, kitchens, etc., must be heater control units, each consisting of a switch, receptacle, and pilot lamp connected in series with switch. Each heater control unit should be wired, for a capacity of 660 watts, or one full circuit.

Corridors should be lighted by ceiling units, consisting of keyless receptacles, shade holders and opalescent glass globes. Each corridor should be controlled by a wall switch.

Storage rooms and closets should be lighted in general by drop cords equipped with wire guards.

Porches should be lighted similar to inside corridors.

Each operating room should be equipped with one 2-light operating unit, wired for a capacity of 660 watts or one full circuit, with local control.

X-Ray Equipment: Feeders for X-Ray equipment should be 115-230 volt, single phase, 3-wire alternating current of sufficient cross sectional area to carry a load of one hundred amperes. Especial care should be taken to install service leads of ample capacity in cases where transformer is not located near the laboratory, and under no circumstances is it advisable to attempt to operate a modern X-Ray equipment where the service transformer is at a distance greater than 500 feet. Where 115 and 230 volt direct current only is available, the X-Ray apparatus should be constructed with an inverted rotary transformer.

Nurses' Call System: Nurses' call system, where deemed necessary, should consist of a set of calling stations with reset provision and pilots at beds arranged to signal nurses' office, designed to operate at 115 volts. The source of current supply should be the lighting cutout cabinet, and no lighting outlets not a part of this system should be connected to any circuit feeding the same.

All wires should be No. 14 B & S gauge rubber-covered single braid and installed in rigid steel conduits, concealed where practicable.

Calling and resetting should be accomplished by 10-ampere double pole pull cord type ceiling switches, substantially fastened in place, one located over each bed. In addition a pilot light should be installed over each bed in wards of 4 beds and larger with another pilot light over the door of the ward on the corridor side connected to burn with any one group of individual bed pilot lamps in the ward. A bank of lamps should be installed in Nurses' office and connected one lamp for each ward or group of wards, as may be required. Wards of less than 4-bed capacity should not be equipped with individual bed pilot lights in addition to ward pilot lights as described hereinabove.

All lamp sockets should be standard base, all lamps of 10-watt capacity, color dipped.

In all cases of two-story buildings, a set of signal lights for first floor should be installed in second floor office, with switch for disconnection if not required and a similar arrangement to take care of second floor calls, installed in first floor office. See Plate No. 124.

WAREHOUSES AND TERMINALS:

All wiring for light and power in semi-fireproof warehouses should be installed in rigid steel conduit run exposed.

All wiring for light and power in fireproof warehouses should be installed in rigid steel conduit concealed as far as possible.

Service for power should be arranged as follows:

(See Primary Voltage-Motor Installations.)

Miscellaneous motors, 220-volt 3-phase alternating current.

Motors for cranes, winches and elevators, 550-volt, direct current or preferably 460-volt. 3-phase, alternating current.

Service for lighting should be arranged for 115-230-volt, 3-wire, single phase alternating current.

Lighting panels should be bus bar type, 3/2 wire with lugs only in mains and push-button switches and plug fuses in branches. Panels should be arranged with slate liners and wiring gutters at top, bottom and sides.

Each building or section supplied from overhead lines should be furnished with a weatherproof safety type service switch and cabinet for lighting mounted on the outside of the building wall at a point convenient to the service entrance drops, but within reach so as to be operable from platform. Distribution should be from weatherproof switch through lighting entrance panel equipped with 3-pole fused circuits to lighting panels for final distribution to outlets. Entrance panels should be slate, bus-bar type, with slate liners and wiring gutters at top, bottom and sides, arranged for the proper number and capacity of 3-pole fused circuits for feeding lighting panels.

No conductors smaller than No. 12 B & S gauge should be installed in any building under this caption.

The general scheme for lighting should be one unit of 100-watt capacity per day of approximately 20 feet by 20 feet. Each unit should be equipped with a grooved porcelain receptacle and enameled steel reflector. Control of circuits should be from cutout cabinet, or in special cases control should be local from push-button wall switches.

Three-phase 220-volt circuits should be installed where required for power receptacles. Main feeder circuits should be extended from service entrance along ceiling and a tap made for each power receptacle in a steel junction box at ceiling height. Each tap should be of same

size as feeder circuit and run in conduit to a threaded fitting enclosing a 3-pole porcelain fuse block located approximately 8 feet above floor level. From this fuse block a 3-wire 30-ampere tap shall be run in conduit down to power outlet located approximately 6 feet above floor level. This power outlet shall consist of a 3-pole receptacle and suitable threaded fitting securely fastened to column or wall. Each power outlet should be provided with a 3-pole plug and one hundred feet of 3-conductor No. 10 B & S gauge deck cable.

Wiring for portable winch equipments shou'd conform to other power wiring, as described above, and each unit should be provided with fifty foot multiple conductor No. 6 B & S, extra flexible, wire armored weatherproof cable, with 100-ampere capacity plug.

Circuit breakers controlling power circuits feeding hoists, cranes and elevators should be provided with reverse phase relays.

Exterior lighting outlets for piers and wharf-houses should consist of 500-watt units with angle type porcelain enameled steel reflector sockets mounted approximately 40 feet above the dock and 60 feet centers. Where exposed to mechanical injury each unit should be protected by pipe guard, constructed as shown on Plate No. 126.

In the event that transformers are to be located inside the buildings, they must be installed in fireproof vaults, ventilated, illuminated and drained, with high tension cutouts, low tension distribution panels, and all necessary fuses and connections. High tension feeders should be multiple conductor paper insulated lead covered cables, brought into vaults, underground in duct, terminating in a suitable pot-head at primary cutouts.

In cases where space limitations or other considerations warrant, transformer vaults may be located on roofs, with high and low tension distribution as described.

Warehouses and other large permanent buildings should be provided with an emergency lighting system, comprising red exit lights, stair and hallway lights, fed from separate transformer and controlled by one master switch.

BATTERY CHARGING STATIONS:

Standard battery charging stations should consist of four 20 KW 30/60 volt 3-wire motor-generator sets, or rotary converters, with independent generator panels (not for parallel operation), distributing to charging outlets, through four charging panels arranged for constant potential charging with fixed resistance to limit the initial current to a safe value.
For specifications and drawings see "Army Catalogue."

MACHINE AND REPAIR SHOPS:

Wiring of machine and repair shops and similar steel constructed buildings should conform to specifications for warehouses, excepting that heavy feeders should be slow burning insulation, run exposed, supported by insulator racks.

HOUSING PROJECTS:

Wiring of buildings of housing projects should be concealed knob and tube, using outlet boxes and simple standard fixtures.

POWDER MAGAZINES:

Lightning Protection: Primer and fuse houses and powder magazines only should be provided with lightning protection, having main aerial points mounted at suitable locations, such as tops of metal ventilators, ridges, etc., and supplementary points mounted at intermediate loca-

tions, and the entire system for each building connected together by 3/8-inch copper cable and properly grounded. Details of material are shown on Plate No. 129. Ground plates should be made and installed as indicated, the ground wire being protected by fiber conduit for a distance of 10 feet above ground. Grounds for ordnance magazine docks should be obtained by means of copper cylinders lowered into the water; details of which are shown on the above plate.

Lighting: Where lighting is required in the interior of magazines, the installation should be made in conduit, using vapor-proof fixtures and fittings with controlling switch mounted in weather-proof box on outside of building. In black powder or other magazines where interior wiring cannot be installed, lighting may be obtained through windows by means of angle type porcelain enameled reflectors mounted on outside of walls.

TENTS:

Each tent should be equipped with a standard porcelain key socket, lamp guard, insulator wire support and sufficient No. 6 canvasite cord to connect to outside service wires. See Plate No. 122.

CONSTRUCTION ON POLES JOINTLY USED FOR SUPPLY AND COMMUNICATION CIRCUITS.

(OFFICE OF THE CHIEF SIGNAL OFFICER—ENGINEERING DEPARTMENT)

SPECIFICATION No. 601.

I. GENERAL.

This specification deals with the location and arrangement of pole fittings on poles jointly used for circuits carrying electrical energy for lighting and power circuits and circuits for communication and signal purposes. The diagrams and text of this specification are intended to cooperate with and supplement each other. Details indicated in one and omitted in the other shall be executed the same as if indicated in both.

Lighting or power circuits and telephone or signal circuits are hereinafter designated as Supply Circuits, and Communication Circuits respectively.

II. DRAWINGS.

The following drawings form part of this specification: 1442, 1443, 1444, 1445, 1446, 1447, 1448.

For Manual reproductions of above drawings, see Plate No.'s 130, 131.

III. POLE SIZES FOR JOINT USE.

Thirty-five foot poles shall be generally used for joint poles. At railroad crossings poles forty feet or more in height shall be used.

Jointly used poles shall be of the following dimensions:

Height, Feet.	Kind	Circumference at top, inches.	Circumference (6 inches from butt) inches.	Class
35	Eastern Cedar	22	38	B
35	Western Cedar	25	36	B
35	Chestnut	22	40	B
40	Eastern Cedar	22	40	B
40	Western Cedar	25	38	B
40	Chestnut	22	43	B

IV. STEPPED POLES.

Joint poles with vertical attachments shall be stepped. Vertical attachments shall be placed to permit free use of pole steps.

V. VERTICAL CLEARANCES AND CLIMBING SPACE.

A clear climbing space shall be maintained to permit light and power employees to climb with reasonable safety up to and through the wires of the Communication Circuits To accomplish this purpose, all communication wires, whether in twisted pair or iron pole brackets or single insulated wire on Hubbard brackets, and all Communication Circuit attachment, shall be placed where practicable on the same side of the pole, preferably away from the street or roadway to provide clearance between the wires and the possible lamp leads run vertically on the pole. When Communication Circuits are carried on cross-arms a clear climbing space of not less than twenty-four inches between pole pins shall be maintained. Drawing No. 1442.

VI. INSULATION OF COMMUNICATION CIRCUIT WIRE.

The insulation on Communication Circuit wires shall be of standard rubber compound or its equivalent, covered with at least one thickness of braided or woven covering.

VII. POSITION OF SUPPLY AND COMMUNICATION CIRCUITS.

Supply circuits and their attachments shall be placed above the Communication Circuits and their attachments. The same cross arm or fixture shall be not used for both circuits.

A vertical distance of not less than forty inches shall be provided and maintained between the wires of the Supply Circuits and the wires of the Communication Circuits, except as noted on Drawing No. 1442 excepting that cables, service wires, connecting wires and ground wires may be run vertically upon a jointly used pole when located and protected as hereinafter provided. Drawings 1443 and 1448.

Messenger wires carrying either lead covered cable or insulated wires may be carried on supports attached directly to the pole, at a vertical distance of not less than four feet below the lowest Supply Circuit cross-arm. When the vertical distance mentioned above does not exceeed six feet a guard arm not less than four feet in length shall be placed upon the pole immediately above the messenger and substantially parallel but not in contact therewith. This guard arm shall be attached to the pole by a machine bolt and one cross-arm brace. Drawings 1443, 1444, and 1447.

Communication cable boxes may be placed on either side of poles jointly used provided they are placed not less than forty inches from the nearest supply wire and do not obstruct the climbing space or the vertical supply wire attachments. Drawings, 1443, 1444, 1447, and 1448.

VIII. FIXTURES FOR SUPPLY AND COMMUNICATION CIRCUITS.

Supply circuits shall be carried on wood cross arms. Communication circuits may be carried in lead covered cable, or insulated wire in rings, supported by a messenger. Where feasible, bare wire may be used on cross arms, Drawing 1442. Iron pole brackets and twisted pair may be used for local distribution, but shall be so placed as to maintain a clear climbing space. Drawings 1443, 1444, 1447 and 1448.

Transformers connected to the supply system may be placed upon poles jointly used, provided they are installed and maintained in accordance with the following requirements:

The transformer shall be of a type in which the containing box is insulated from contact with the transformer coils and their connections; it being understood that in case a ground is employed upon the secondary circuit, the transformer case may also be grounded. In no case shall the transformer, or its parts or connections, be located within a vertical distance or less than forty inches above communication wires, connections or attachments. Drawing 1443.

Switches, cut-outs and similar apparatus used in connection with supply circuits where located below communication wires shall be of a type in which all live parts are covered or protected from accidental contact.

Communication Circuit drop wires may be attached to the guard arm by knobs. Drawing 1443. On poles not provided with guard arms similar arms for distribution may be provided. Drop wires may also be attached to the pole by brackets or separate knobs, providing the climbing space is not obstructed. Drawings 1444, 1447 and 1448.

Span wires or brackets for street lamps may be attached to poles jointly used, and street lamps operated upon either the arc or incandescent system may be maintained upon the same, provided the fixtures and lamps shall conform to the following requirements: Drawings 1444 and 1445.

No fixture or any of its metal parts shall encircle the pole. The attachment shall be restricted to the face or back of the pole or to the half of the pole toward the lamp, except that span wires or brackets may be attached by bolts passing through the pole. The vertical clearance between lamps, fixtures and messengers carrying communication cables or wires shall not be less than twelve inches. Drawings 1444 and 1447. Where a cable terminal must be mounted less than twelve inches vertically from the fixture, it shall be located approximately ninety degrees therefrom. The lamp and its electrical connections shall be effectually insulated from its supporting fixtures by insulation or adequate mechanical strength, and the insulation shall be able to withstand, when wet, a breakdown test of at least twice the maximum voltage of the circuit to which the lamp is connected. A strain insulator shall be inserted in every span wire six to eight feet from the pole.

IX. SERVICE TAPS TO SUPPLY LINES.

Connection to supply lines for service, street lamps, or connections to underground wires, and, in general, connections forming a part of the supply system, may be run vertically upon a pole and if necessary through or by communication wires, provided, however, such supply wires and connections are so constructed, placed and maintained as to conform to the following requirements: Drawings 1444 and 1447.

Where such wires or connections are run through or by communication wires, the connections from a point not less than forty inches above, to their terminal point below the communication lines, shall be made with twin conductor wire each conductor wire being insulated with a standard rubber compound, or its equivalent, and each pair of wires being covered together by

at least one thickness of weatherproof braided or woven covering. This twin conductor shall be either carried down the pole through a conduit of solid insulating material, the conduit being securely attached to the pole; or it shall be carried down the pole taut and fastened upon standard insulators, which shall be supported upon pins or brackets so constructed and attached to the pole that the twin cable shall be firmly held at a distance of not less than five inches from the surface of the pole.

Lead sheath cable carrying Supply Circuits shall be inclosed within a pipe or conduit of solid insulating material between a point not less than forty inches above the highest communication wire and a point not less than six feet below the lowest communication wire. Ground wires shall be run in fibre conduit or otherwise effectually insulated and protected throughout the entire attachment to the pole.

X. SERVICE TAPS TO COMMUNICATION CIRCUITS.

Connection wires, service wires ground wires or lead covered cables forming a part of the communication system may be run vertically upon a pole, provided they are constructed and maintained in accordance with the following requirements:

The wires throughout their attachment to the pole shall be insulated with standard rubber compound or its equivalent, and covered with at least one thickness of weather-proofed braided or woven covering. Lead cables carrying Communication Circuits may be run vertically on the pole providing they are inclosed in pipe or conduit of solid insulating material where unprotected vertical runs of Supply Circuit Wires are paralleled. Communication ground wires throughout the entire attachment to the pole shall be enclosed within an insulating conduit or otherwise effectually insulated and protected.

Joint poles with vertical attachments shall be stepped. Vertical attachments shall be so placed as not to interfere with the use of the pole steps.

XI. LOCATIONS AND CLEARANCES FOR GUYS.

Guy anchors shall where practicable, be placed at a horizontal distance from the pole they reinforce, measured at the ground line, not less than two-thirds of the height above ground of the point of attachment of the guy to the pole. All guys, except anchor guys, shall preferably be attached to non-conducting supports and so placed and maintained that no part of any guy shall be within eight feet of the ground. Drawing 1445. Guys crossing roadways shall clear by at least eighteen feet. Guys crossing footways shall clear by at least ten feet. Drawing 1445. All guys shall clear by at least four inches from the nearest wire on the guyed pole. Drawing 1446.

Guys which pass over or under supply wires, other than those on the guyed pole, shall be so placed as to maintain a minimum clearance of two feet between guy and supply wires.

Guys shall be free of contact with all wires, cables, messenger wires and ground wires, and shall not contact with other guys except those on the same pole, stub, or anchor.

XII. LOCATION OF STRAIN INSULATORS.

Each guy wire attached to a pole jointly used shall be insulated by the insertion of one or more strain insulators, Drawings 1445 and 1446. A second strain insulator shall be placed in each guy, except those attached to a wood guy stub at a point more than eight (8) feet above ground. The second strain insulator shall be placed at a point between six (6) and eight (8) feet from the object to which the farther end of the guy is attached, provided, always, that the insulator so located shall not be less than eight (8) feet above the ground. Drawings, 1445 and 1446. In the case of guys in which a point eight (8) feet from the point of attachment of far-

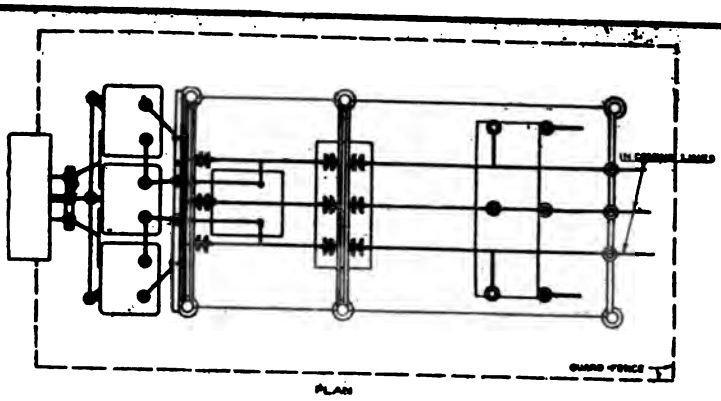
ther end of the guy is less than eight (8) feet above the ground, the second strain insulator shall be placed eight (8) feet in vertical distance from the ground. In anchor guys, the strain insulator shall be placed between eight (8) and ten (10) feet vertically from the ground. Drawing 1446. Where guys are attached to a stub at a point more than eight (8) feet above ground, the anchor guy from the stub shall have a strain insulator located at a point not less than eight (8) feet above ground, i. e., guys in which the two strain insulators here required would be located within five (5) feet of each other only one strain insulator need be used.

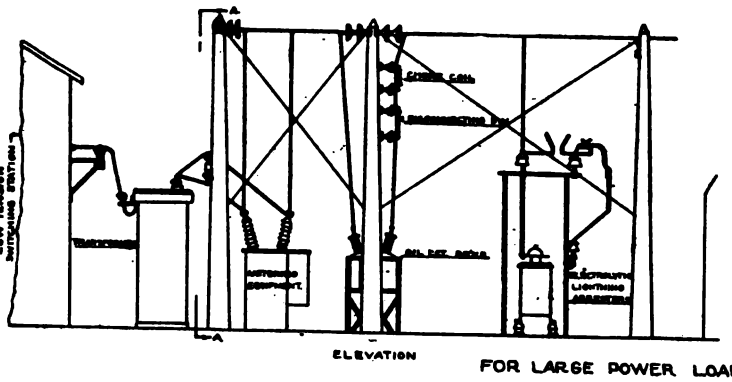
XIII. MECHANICAL STRENGTH OF STRAIN INSULATORS.

Strain insulators used in guys shall be at least equal in mechanical strength to the tensile strength of the guys in which they are used. They shall be preferably of the interlocking type.

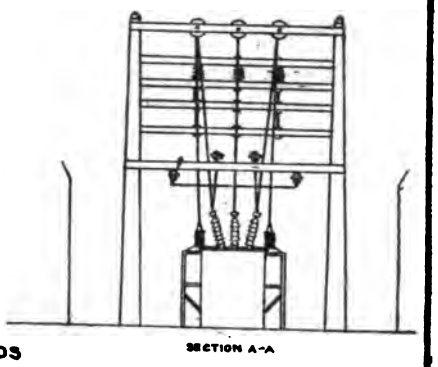
XIV. INSULATING REQUIREMENTS OF STRAIN INSULATORS.

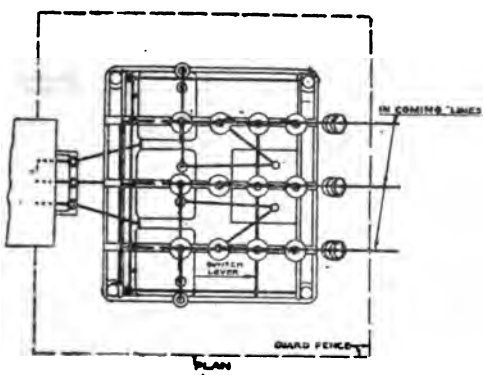
Strain insulators used in guys shall not flash over at twice the maximum line voltage under a uniform precipitation of water of one-fifth (1/5) of an inch per minute at an inclination of forty-five degrees (45°) to the axis of the insulator.

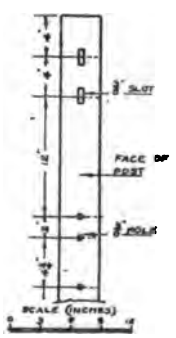


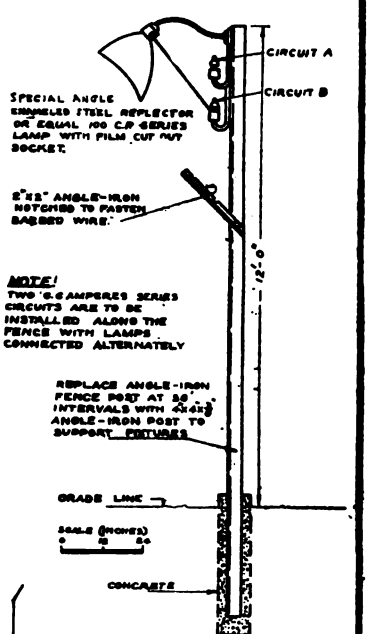


FOR LARGE POWER LOADS

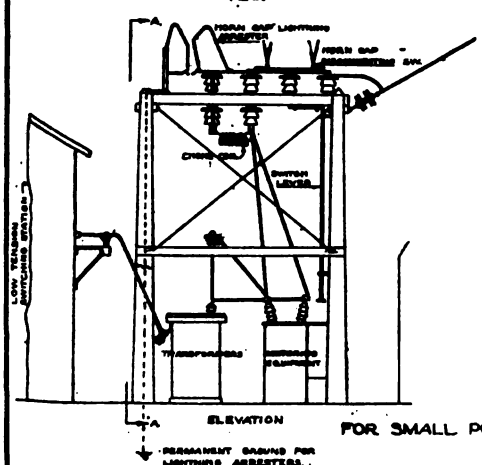


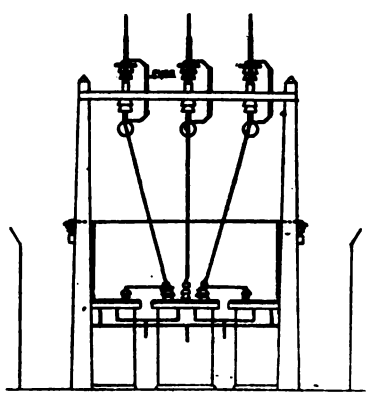





CIRCUIT A
CIRCUIT B
SPECIAL ANGLE ENAMELED STEEL REFLECTOR OR EQUAL 100 C.P. SERIES LAMP WITH FILM CUT OUT SOCKET.
2"x2" ANGLE-IRON NOTCHED TO FASTEN BARBED WIRE.
NOTE! TWO 6.6 AMPERES SERIES CIRCUITS ARE TO BE INSTALLED ALONG THE FENCE WITH LAMPS CONNECTED ALTERNATELY
REPLACE ANGLE-IRON FENCE POST AT 50' INTERVALS WITH 4x4x3/8 ANGLE-IRON POST TO SUPPORT FIXTURES
GRADE LINE
CONCRETE

PROTECTIVE FENCE LIGHTING
DETAIL OF FIXTURES AND MOUNTING





FOR SMALL POWER LOADS

FOR ORIGINAL SEE DRAWINGS-67514-15

CONSTRUCTION DIVISION OF THE ARMY

TYPICAL HIGH TENSION OUTDOOR SUB-STATIONS

DETAILS OF PROTECTIVE FENCE LIGHTING

NOTE:
WHEN LIGHT AND POWER SECONDARY ARE CONNECTED TO SAME GROUND, THE POWER GROUND MUST BE ON THE SAME PHASE AS LIGHTING GROUND

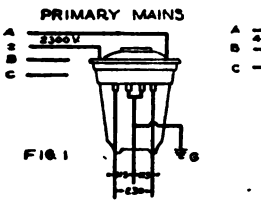


FIG. 1

SECONDARY MAINS
SINGLE PHASE CONNECTIONS

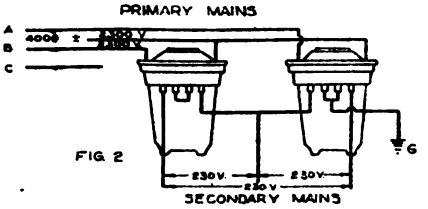


FIG. 2

SECONDARY MAINS

TWO TRANSFORMERS
3 PHASE CONNECTIONS
(FOR 20 K.W. OR LESS)

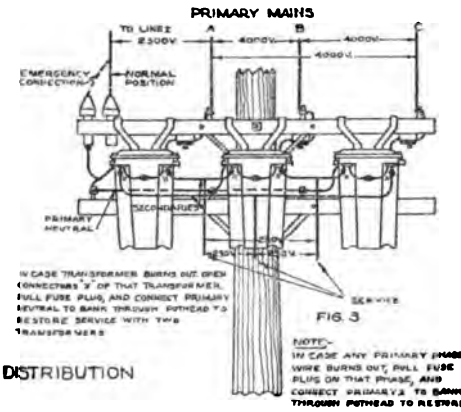
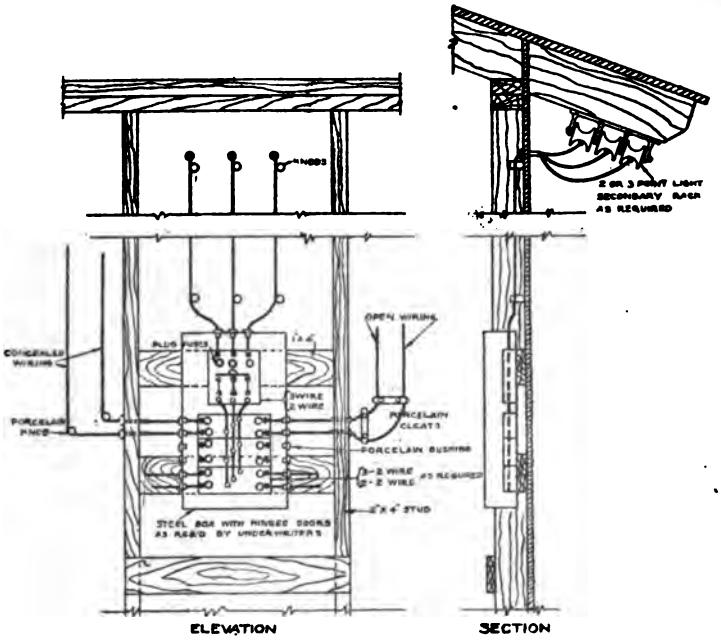


FIG. 3

NOTE:-
IN CASE ANY PRIMARY PHASE WIRE BURNS OUT, PULL FUSE PLUG ON THAT PHASE, AND CONNECT PRIMARY'S TO BANK THROUGH POTHEAD TO RESTORE SERVICE

TRANSFORMER CONNECTION 4 WIRE — 3 PHASE DISTRIBUTION

THREE TRANSFORMERS
3 PHASE CONNECTIONS
(FOR MORE THAN 20 K.W.)



TYPICAL DETAIL OF DISTRIBUTING PANEL

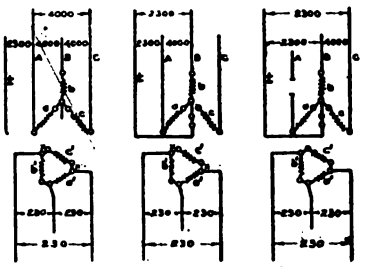


DIAGRAM OF CONNECTIONS FOR NORMAL OPERATION

DIAGRAM OF CONNECTIONS IN CASE ONE TRANSFORMER BURNS OUT

DIAGRAM OF CONNECTIONS IN CASE ONE PRIMARY PHASE WIRE BURNS OUT

THREE TRANSFORMERS 3 PHASE CONNECTIONS
PRIMARY NEUTRAL TO BE GROUNDED AT THE STATION ONLY

FIG 3A.

ELECTRIC WIRING CONVENTIONS — INTERIOR WORK

- PORCELAIN KEYLESS CEILING RECEPTACLE AND 8" CONE PAINT ENAMEL, STEEL REFLECTOR UNLESS OTHERWISE INDICATED
- DROP CORD OUTLET PORCELAIN ROSETTE, PENDANT CAP KEY SOCKET 8" CONE PAINT ENAMEL STEEL REFLECTOR, "R" CORD 6'-6" FROM FLOOR. @ 7'-6" OR SPECIAL HEIGHT WHERE CONTROLLED BY SWITCH)
- DROP CORD AS ABOVE, KEY 4'-0" FROM FLOOR CORD TO HAVE ADJUSTER
- PULL CHAIN PORCELAIN CEILING RECEPTACLE; CORD 6'-0" FROM FLOOR; 8" PORC. STEEL REFLECTORS, EXCEPT WHERE OTHERWISE SHOWN
- PORCELAIN KEYLESS CEILING RECEPTACLE AND 6"x 8" GLASS BALL
- PULL CHAIN PORCELAIN CEILING RECEPTACLE AND 6"x 8" GLASS BALL
- WIRE LAMP GUARD, IN PLACE OF REFLECTOR
- PORCELAIN ENAMEL SYALLOW BOWL REFLECTOR SOCKET, OUTSIDE GOOSE NECK, THREADED FITTING ON END, FOR CONNECTION INSIDE OF BUILDING TO WIRING KEY IN CONDUIT
- S 10 AMP. S.P. SNAP SWITCH, CONCEALED BASE FOR KNOB AND TUBE WORK.
- S 10 AMP. 3.P. FLUSH PUSH BTN. IN THREADED CONDUIT FITTING FOR EXPOSED CONDUIT JOBS, OR WITH THREADED CONDUIT FITTING AND CONDUIT ON WALL FOR CLEAT WORK
- 6 AMP. PLUG RECEPTACLE SURFACE TYPE, CONCEALED BASE SURFACE TYPE FOR KNOB AND TUBE WORK.
- 6 AMP. PLUG RECEPTACLE FLUSH TYPE, IN THREADED CONDUIT FITTINGS FOR CONDUIT JOBS, OR WITH THREADED CONDUIT FITTINGS AND CONDUIT ON WALL FOR CLEAT WORK
- P THE LETTER 'P' INDICATES PORCELAIN KEY SOCKET
- STEEL CUTOUT CABINET WITH SWITCH AND CUTOUTS AS SHOWN ON PLANS

ELECTRIC WIRING CONVENTIONS — OUTDOOR WORK.

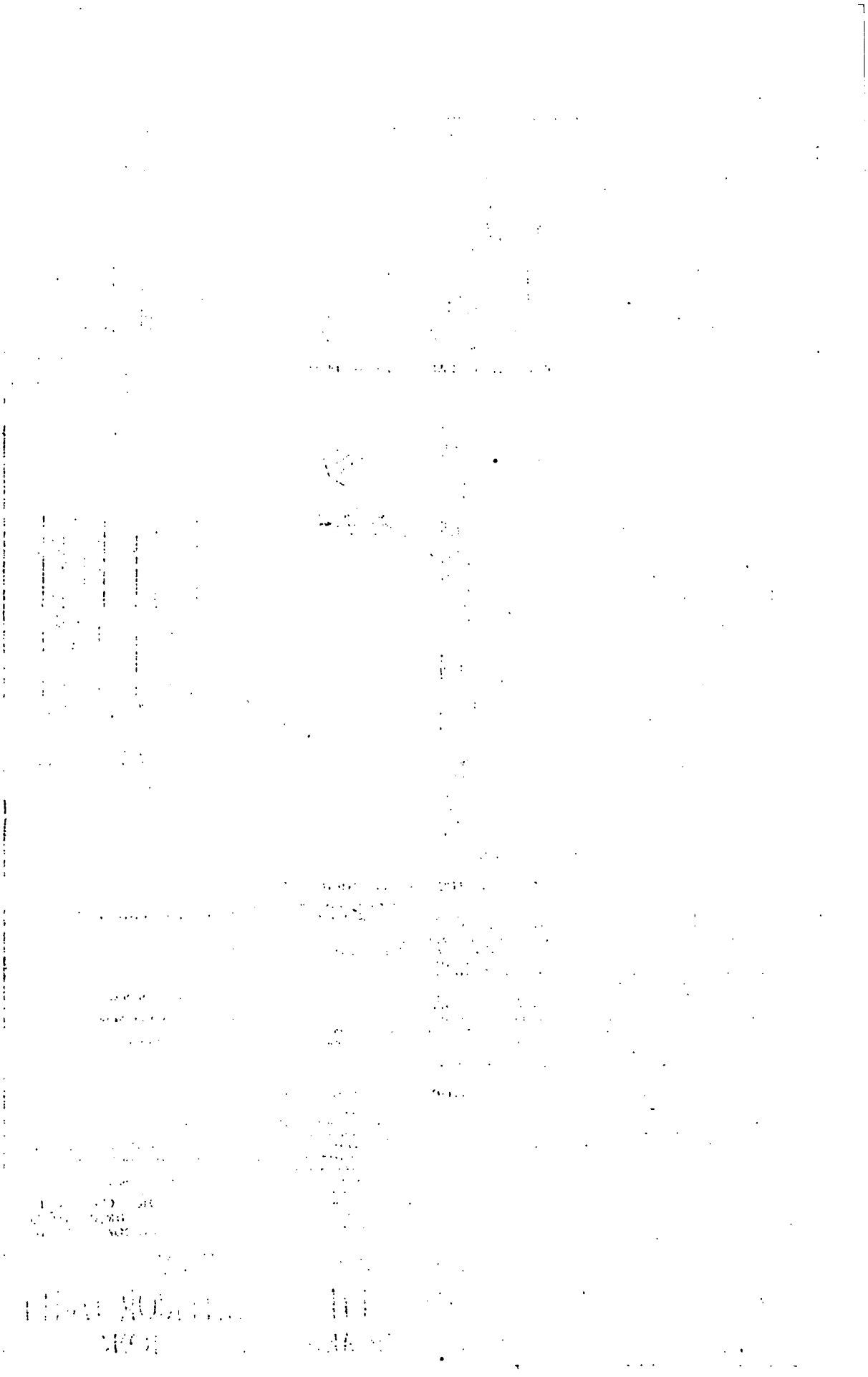
- 3 PHASE, 4 WIRE PRIMARY LINE
- 3 PHASE, 3 WIRE PRIMARY LINE
- SINGLE PHASE PRIMARY BRANCH
- 3 WIRE SINGLE PHASE SECONDARY LINES AND SERVICES, 110-220 VOLTS
- 2 WIRE SECONDARY LINES
- 3 PHASE SECONDARY LINES
- SERIES STREET LIGHTING CIRCUIT,
- 40 FOOT POLE
- 35 FOOT POLE
- 30 FOOT POLE
- 25 FOOT POLE
- 20 FOOT POLE
- DISTRIBUTING TRANSFORMER, K.V.A. CAPACITY AS MARKED
- CONSTANT CURRENT TRANSFORMER AS MARKED
- STREET LIGHT BRACKET ON POLE; 6.6 AMP., 100 C.P. TYPE 'C' SERIES MAZDA LAMP
- SINGLE POLE HIGH TENSION FUSE SWITCH; ONE FOR EACH WIRE. NUMERAL INDICATES NUMBER TO BE INSTALLED
- BANK OF SINGLE POLE LIGHTNING ARRESTERS, NUMERAL INDICATES NUMBER TO BE INSTALLED
- GUY, INSULATOR AND ANCHOR
- CUTOUTS IN WATERPROOF BOX ON POLE
- DISCONNECTING POTHEADS

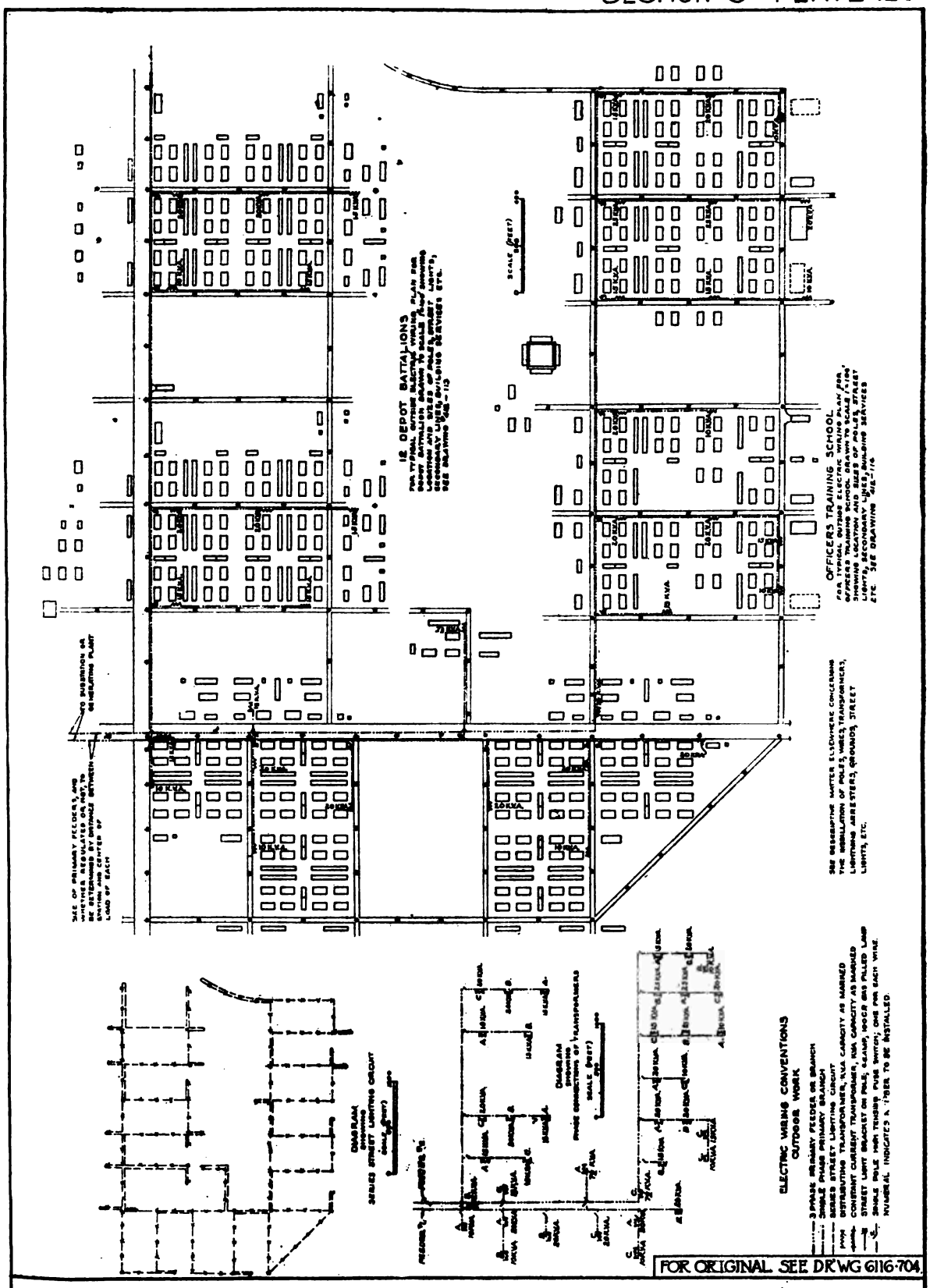
FOR ORIGINAL SEE DRAWINGS 620-367 · 675-12

CONSTRUCTION DIVISION OF THE ARMY

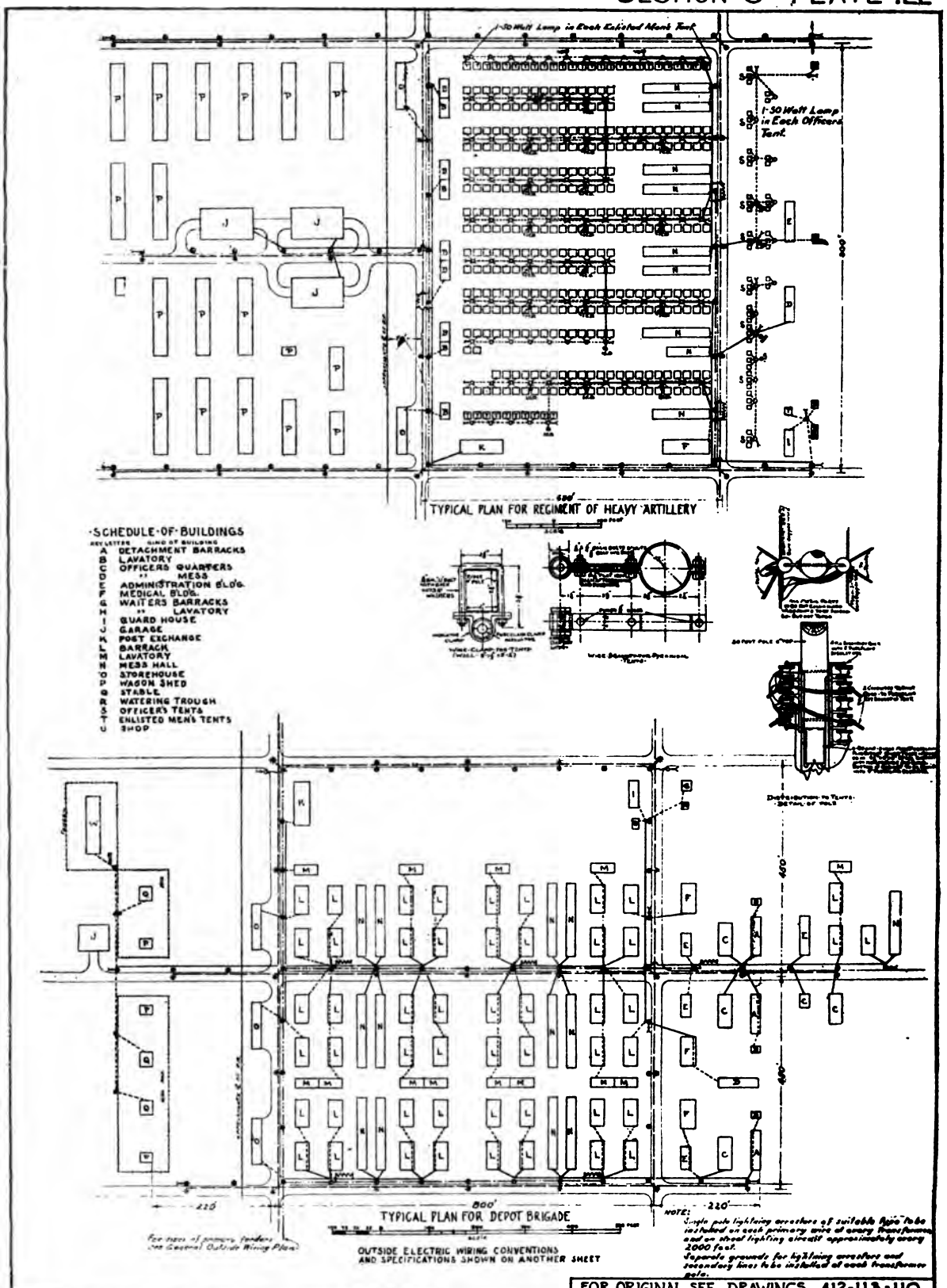
ELEC. WIRING CONVENTIONS - TYPICAL INTERIOR PANEL

3 PHASE 4 WIRE TRANSFORMER CONNECTIONS





CONSTRUCTION DIVISION OF THE ARMY
OUTDOOR ELECTRICAL DISTRIBUTION
PRIMARY AND STREET LIGHTING SYSTEMS

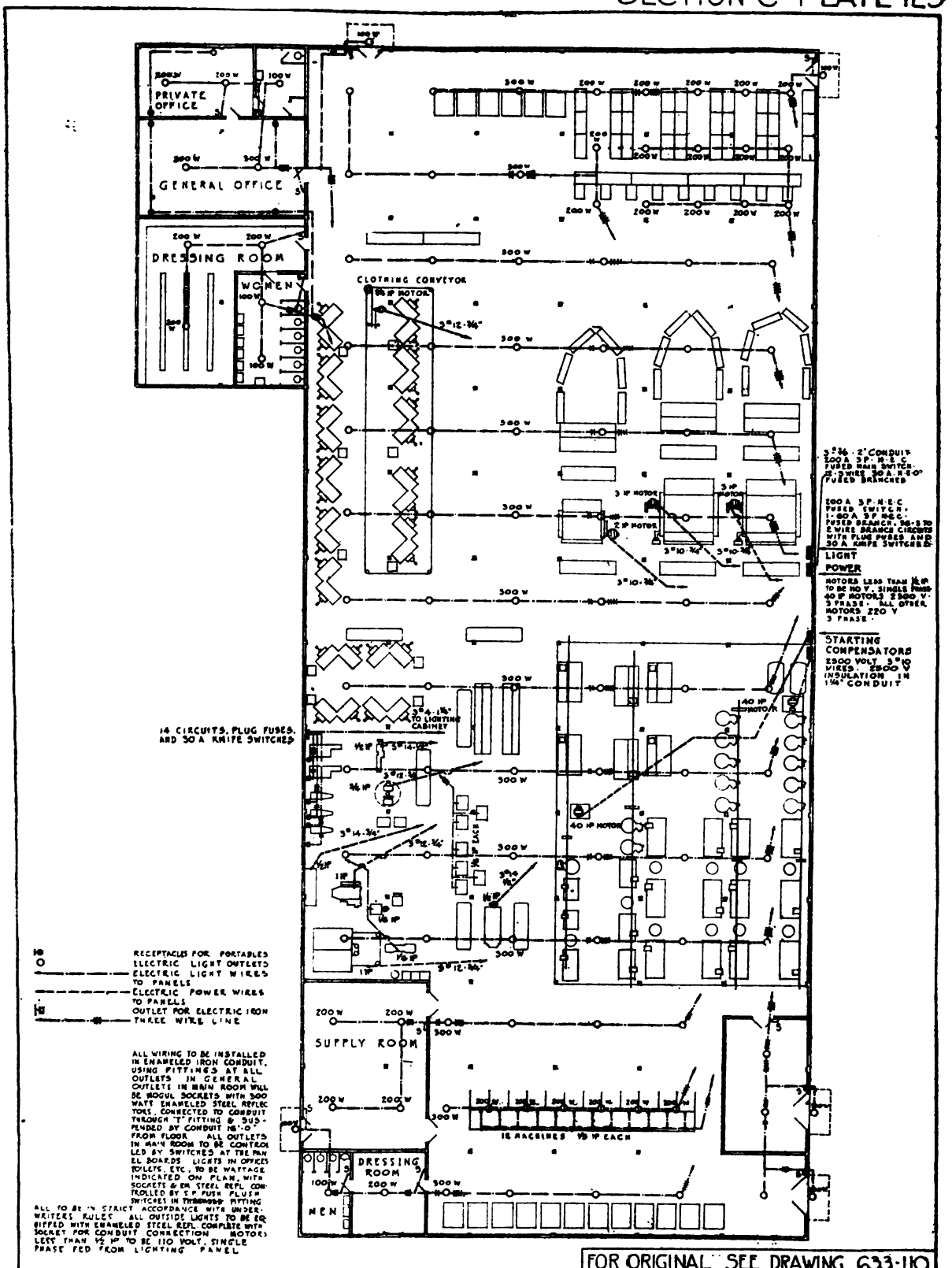

1-50 Watt Lamp in Each Officers' Tent
TYPICAL PLAN FOR REGIMENT OF HEAVY ARTILLERY
SCHEDULE OF BUILDINGS
A DETACHMENT BARRACKS
B LAVATORY
C OFFICERS QUARTERS
D " MESS
E ADMINISTRATION BLDG.
F MEDICAL BLDG.
G WAITERS BARRACKS
H " LAVATORY
I GUARD HOUSE
J GARAGE
K POST EXCHANGE
L BARRACK
M LAVATORY
N MESS HALL
O STOREHOUSE
P WAGON SHED
Q STABLE
R WATERING TROUGH
S OFFICER'S TENTS
T ENLISTED MEN'S TENTS
U SHOP
TYPICAL PLAN FOR DEPOT BRIGADE
OUTSIDE ELECTRIC WIRING CONVENTIONS AND SPECIFICATIONS SHOWN ON ANOTHER SHEET
NOTE:
Single pole lightning arresters of suitable type to be installed on each primary wire at every transformer and on aerial lighting circuit approximately every 2000 feet.
Separate grounds for lightning arresters and secondary lines to be installed at each transformer pole.

FOR ORIGINAL SEE DRAWINGS 412-113-110

CONSTRUCTION DIVISION OF THE ARMY

OUTDOOR ELECTRICAL DISTRIBUTION

SECONDARY LINES AND SERVICES

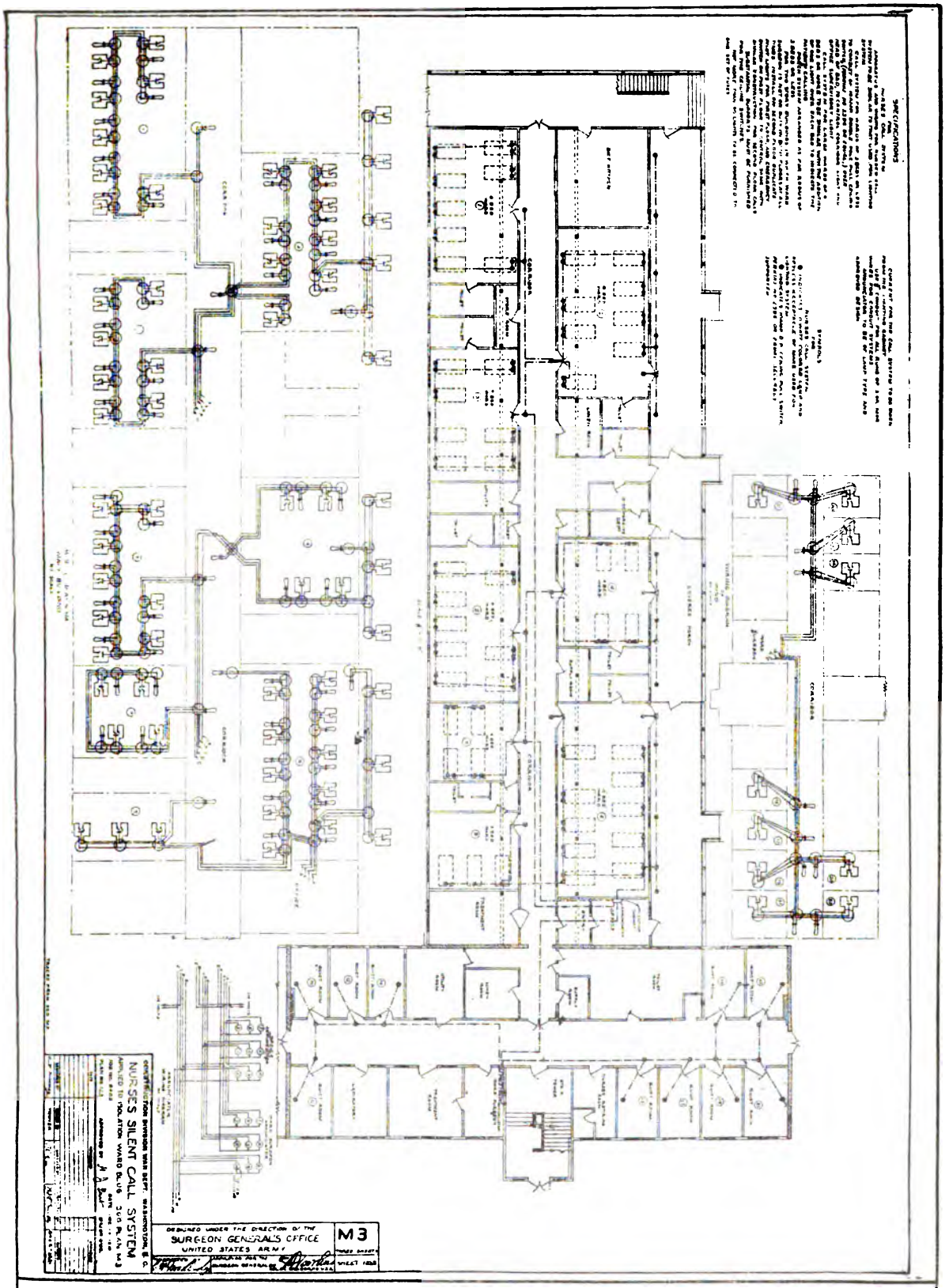

PRIVATE OFFICE
GENERAL OFFICE
DRESSING ROOM
WOMEN
CLOTHING CONVEYOR
5 HP MOTOR
3 HP MOTOR
2 HP MOTOR
40 HP MOTOR
14 CIRCUITS, PLUG FUSES, AND 30 A KNIFE SWITCHED
TO LIGHTING CABINET
SUPPLY ROOM
16 MACHINES 15 HP EACH
DRESSING ROOM
MEN
LIGHT
POWER
STARTING COMPENSATORS
RECEPTACLES FOR PORTABLES
ELECTRIC LIGHT OUTLETS
ELECTRIC LIGHT WIRES TO PANELS
ELECTRIC POWER WIRES TO PANELS
OUTLET FOR ELECTRIC IRON
THREE WIRE LINE
ALL WIRING TO BE INSTALLED IN ENAMELED IRON CONDUIT, USING FITTINGS AT ALL OUTLETS. IN GENERAL, OUTLETS IN MAIN ROOM WILL BE MOGUL SOCKETS WITH 500 WATT ENAMELED STEEL REFLECTORS, CONNECTED TO CONDUIT THROUGH "T" FITTING & SUSPENDED BY CONDUIT 16'-0" FROM FLOOR. ALL OUTLETS IN MAIN ROOM TO BE CONTROLLED BY SWITCHES AT THE PANEL BOARDS. LIGHTS IN OFFICES, TOILETS, ETC., TO BE WALTAGE INDICATED ON PLAN, WITH SOCKETS & ENAMELED STEEL REFL. CONTROLLED BY S.P. PUSH PLUSH SWITCHES IN THROUGH FITTING
ALL TO BE IN STRICT ACCORDANCE WITH UNDERWRITERS RULES. ALL OUTSIDE LIGHTS TO BE EQUIPPED WITH ENAMELED STEEL REFL. COMPLETE WITH SOCKET FOR CONDUIT CONNECTION. MOTORS LESS THAN ½ HP TO BE 110 VOLT, SINGLE PHASE FED FROM LIGHTING PANEL

FOR ORIGINAL SEE DRAWING 633-110

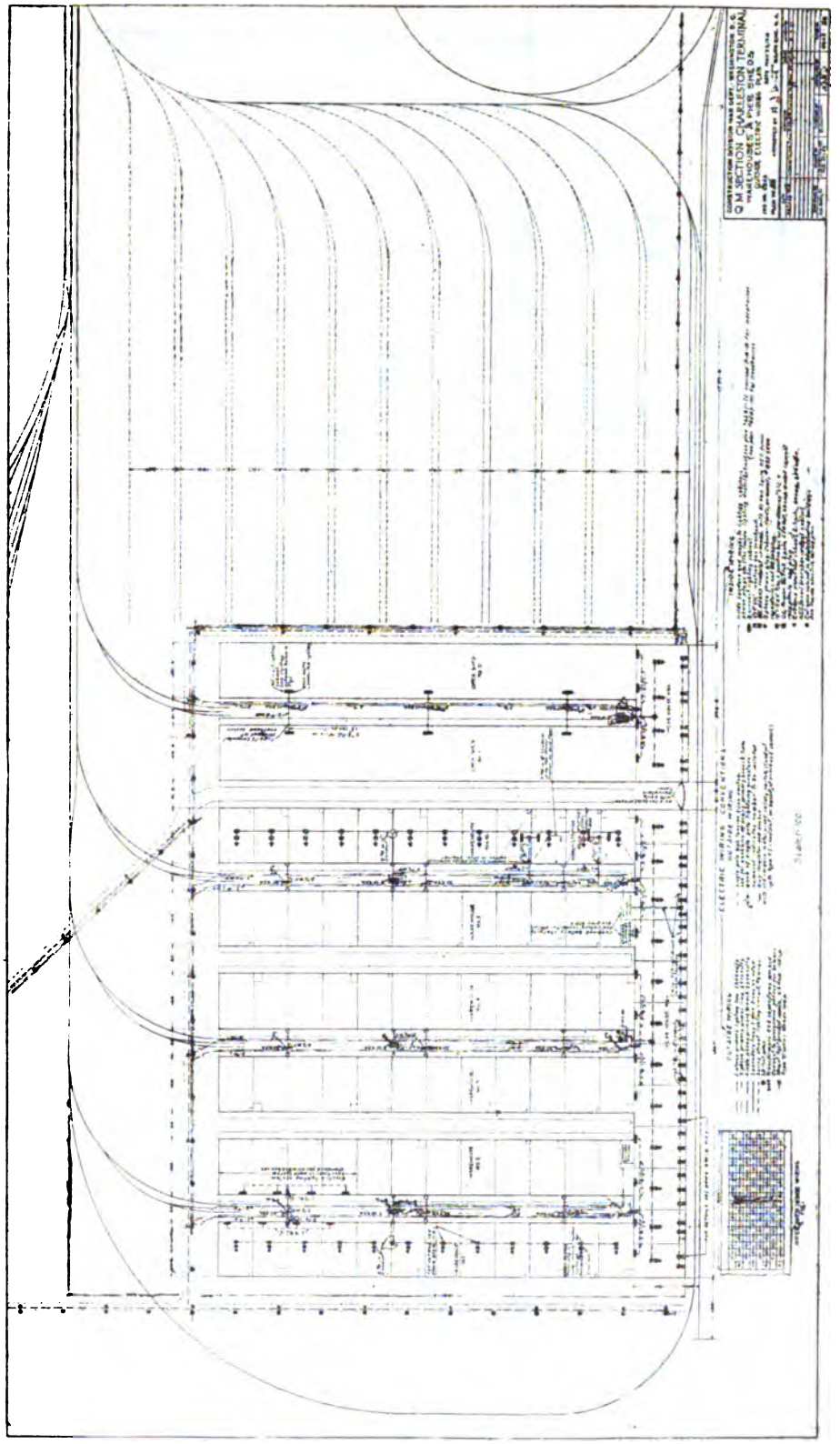
CONSTRUCTION DIVISION OF THE ARMY

LAUNDRY FOR 10,000 TO 20,000 MEN

ELECTRIC WIRING FOR LIGHT AND POWER



CONSTRUCTION DIVISION OF THE ARMY
HOSPITAL WARDS
NURSES SILENT CALL SYSTEM



CONSTRUCTION DIVISION OF THE ARMY

SEMI-FIREPROOF TERMINAL WAREHOUSES

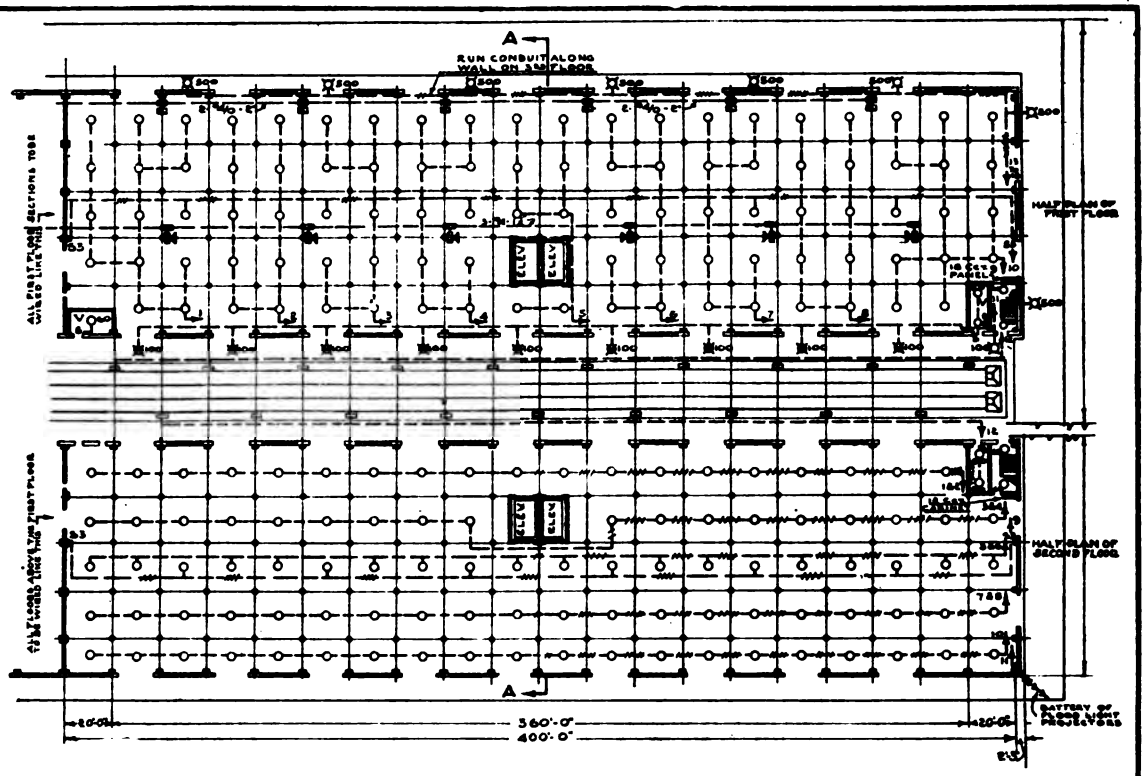
OUTDOOR ELECTRICAL DISTRIBUTION

FOR ORIGINAL SEE DRAWING 6243-72.

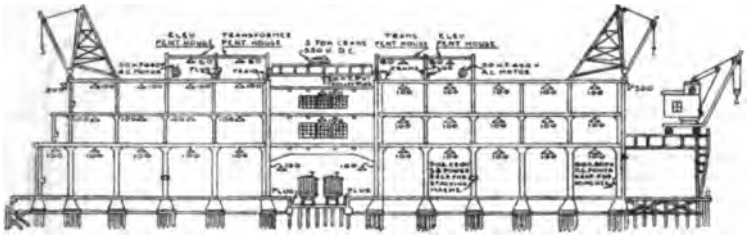
CONSTRUCTION DIVISION OF THE ARMY

SEMI-FIREPROOF WAREHOUSE

ELECTRIC WIRING



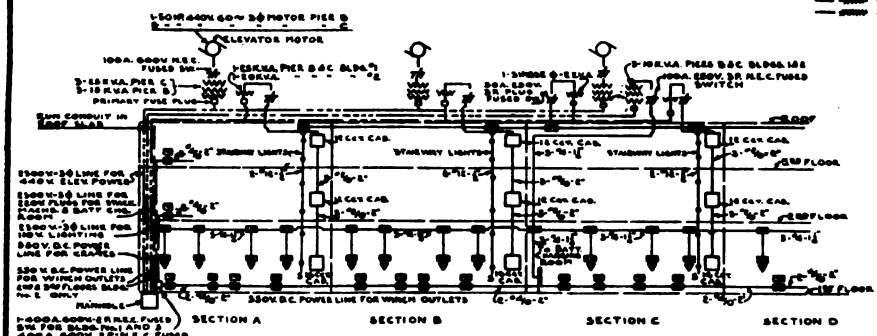
SECTION "D"



CROSS SECTION

ELECTRIC WIRING SYMBOLS

- LIGHTING DISTRIBUTION PANEL
- 4"×4"×1½" JUNCTION BOX, OVERHEAD
- PUTSLINE WITH 60 AMP. S.P.N.E.C. FUSES
- 3 PHASE POWER PLUG RECEPTACLES
- 10"×10"×4" TYPE A JUNCTION BOX AS PER DRWG. #575-6
- D.C. POWER OUTLET - 2 POLE, 250 V. 60A. D.C. RECEPTACLE & PLUG
- CEILING OUTLET, 4"×4" DEEP OUTLET BOX RECEPTACLE & ENAMELLED STEEL REFLECTOR
- DOCK LIGHT OUTLET WITH ANGLE REFLECTOR & 300 WATT MAZDA LAMP
- 36" GOOSENECK [PIPE SHALLOW BOWL REFLECTOR & 100 WATT LAMP
- LIGHTING RECEPTACLE FOR INTERIOR OF FREIGHT CARS
- FLOOD LIGHT PROJECTORS MULT. LAMP
- S SINGLE POLE PUSH SWITCH
- 2-#12 R.C. - ½" CONDUIT
- 3 - - ¾" -
- 4 - - ¾" -
- 9 - - 1" -
- 8 - - 1¼" -



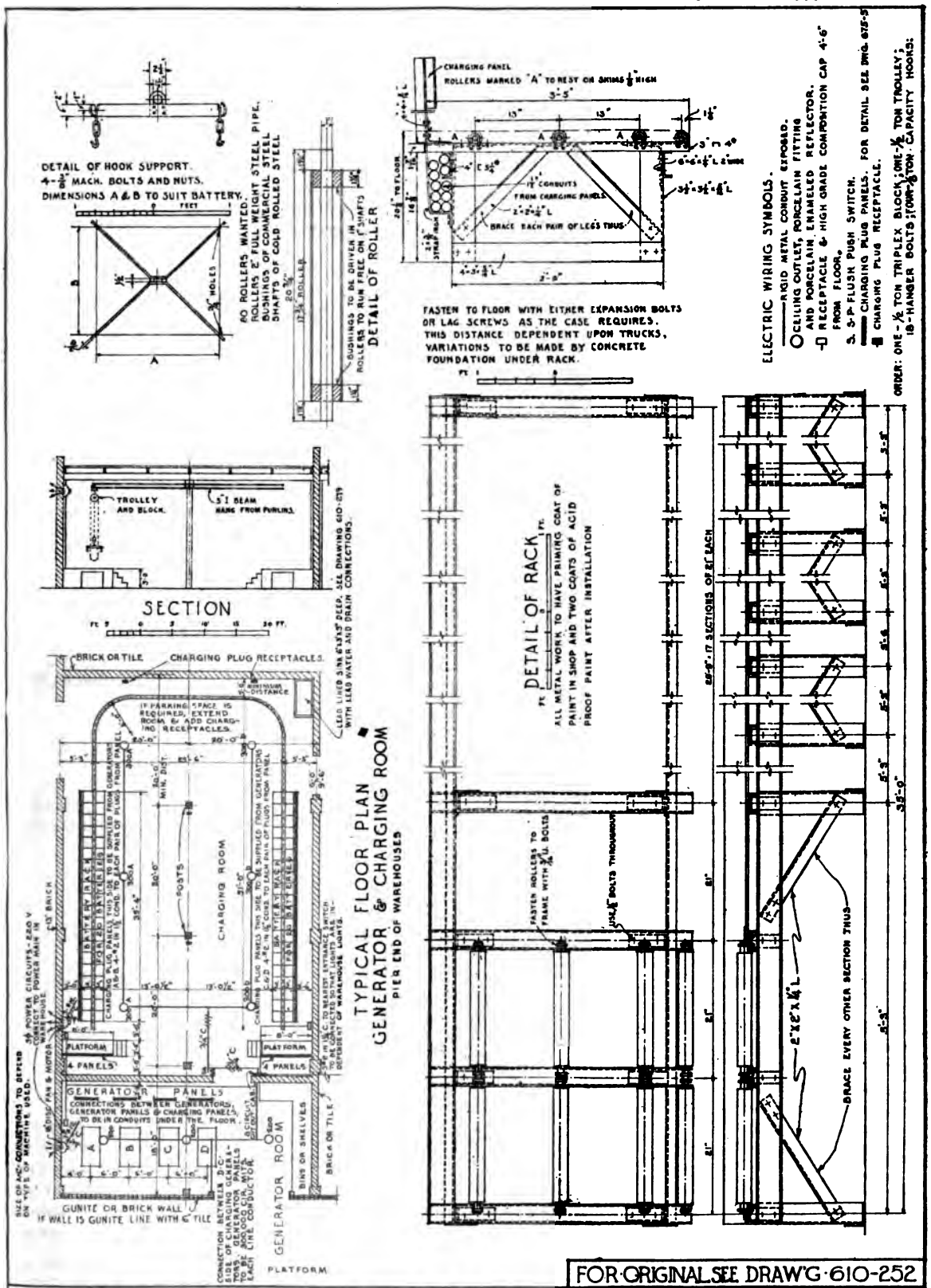
WIRING DIAGRAM - PIERS B & C - BLDGS. 1 & 2

FOR ORIGINAL SEE DRAWING 6352-158

CONSTRUCTION DIVISION OF THE ARMY

FIREPROOF TERMINAL WAREHOUSE

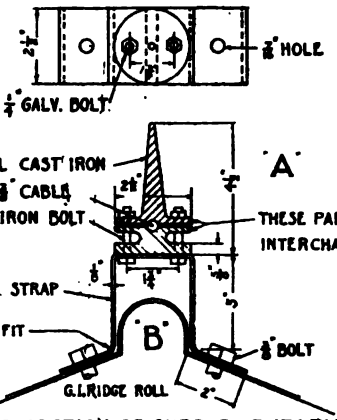
ELECTRIC WIRING FOR LIGHT AND POWER


DETAIL OF HOOK SUPPORT.
4-⅞" MACH. BOLTS AND NUTS.
DIMENSIONS A & B TO SUIT BATTERY.
40 ROLLERS WANTED.
ROLLERS 6" FULL WEIGHT STEEL PIPE.
BUSHINGS OF COMMERCIAL STEEL
SHAFTS OF COLD ROLLED STEEL
DETAIL OF ROLLER
CHARGING PANEL
ROLLERS MARKED "A" TO REST ON SKIDS 4" HIGH
1½" CONDUITS FROM CHARGING PANELS
BRACE EACH PAIR OF LEGS THUS
FASTEN TO FLOOR WITH EITHER EXPANSION BOLTS OR LAG SCREWS AS THE CASE REQUIRES. THIS DISTANCE DEPENDENT UPON TRUCKS. VARIATIONS TO BE MADE BY CONCRETE FOUNDATION UNDER RACK.
ELECTRIC WIRING SYMBOLS.
RIGID METAL CONDUIT EXPOSED.
CEILING OUTLET, PORCELAIN FITTING AND PORCELAIN ENAMELED REFLECTOR.
RECEPTACLE & HIGH GRADE COMPOSITION CAP 4'-6" FROM FLOOR.
3, S-P FLUSH PUSH SWITCH.
CHARGING PLUG PANELS. FOR DETAIL SEE DWG. 672-5
CHARGING PLUG RECEPTACLE.
ORDER: ONE-½ TON TRIPLEX BLOCK; ONE-½ TON TROLLEY; 18-HANGER BOLTS (FOUR-½ TON CAPACITY HOOKS)
TROLLEY AND BLOCK.
5" I BEAM HUNG FROM PURLINS.
SECTION
BRICK OR TILE
CHARGING PLUG RECEPTACLES.
IF PARKING SPACE IS REQUIRED, EXTEND ROOM & ADD CHARGING RECEPTACLES.
CHARGING ROOM
BATTERY RACK
POSTS
PLATFORM
4 PANELS
GENERATOR PANELS
CONNECTIONS BETWEEN GENERATORS, GENERATOR PANELS & CHARGING PANELS TO BE IN CONDUITS UNDER THE FLOOR.
GENERATOR ROOM
BINS OR SHELVES
GUNITE OR BRICK WALL
IF WALL IS GUNITE LINE WITH 6" TILE
TYPICAL FLOOR PLAN
GENERATOR & CHARGING ROOM
PIER END OF WAREHOUSES
DETAIL OF RACK
ALL METAL WORK TO HAVE PRIMING COAT OF PAINT IN SHOP AND TWO COATS OF ACID PROOF PAINT AFTER INSTALLATION
FASTEN ROLLERS TO FRAME WITH ¾" Ø BOLTS
¾" Ø BOLTS THROUGHOUT
BRACE EVERY OTHER SECTION THUS
2"x2"x¼" L

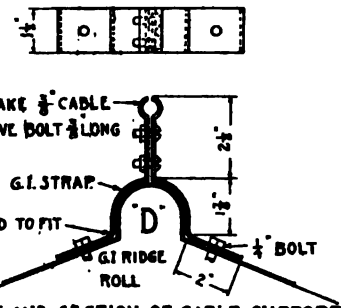
FOR ORIGINAL SEE DRAW'G 610-252

CONSTRUCTION DIVISION OF THE ARMY

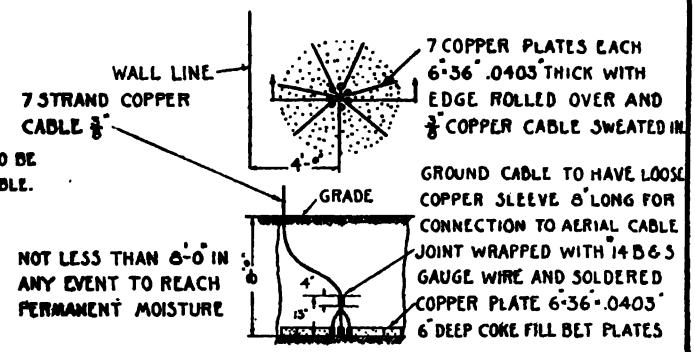
TYPICAL BATTERY CHARGING STATION FOR TWENTY STANDARD TRACTORS



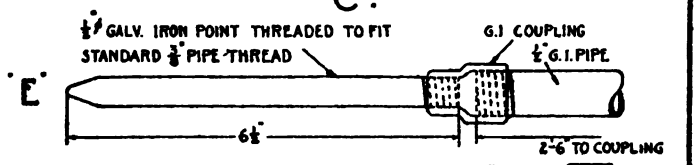
PLAN AND SECTION OF SUPPLEMENTARY POINT AND SUPPORT.



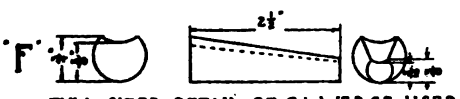
PLAN AND SECTION OF CABLE SUPPORT


WALL LINE
7 STRAND COPPER CABLE ⅜"
7 COPPER PLATES EACH 6"×36"×.0403" THICK WITH EDGE ROLLED OVER AND ⅜" COPPER CABLE SWEATED IN
GRADE
GROUND CABLE TO HAVE LOOSE COPPER SLEEVE 8" LONG FOR CONNECTION TO AERIAL CABLE
JOINT WRAPPED WITH #14 B&S GAUGE WIRE AND SOLDERED
NOT LESS THAN 6'-0" IN ANY EVENT TO REACH PERMANENT MOISTURE
COPPER PLATE 6"×36"×.0403"
6" DEEP COKE FILL BET PLATES

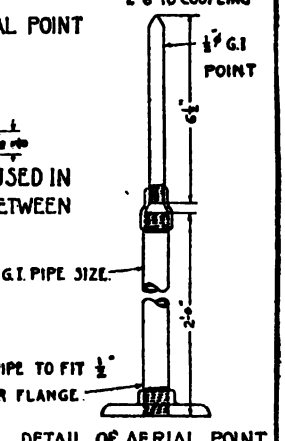
PLAN AND SECTION OF GROUND



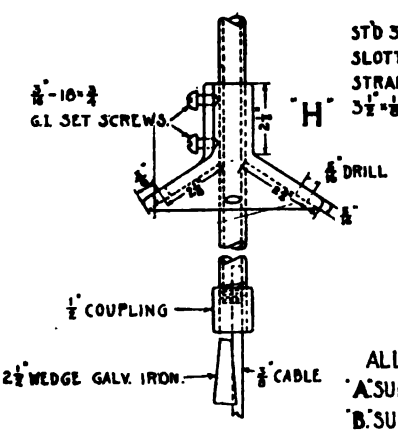
FULL SIZE DETAIL OF MAIN AERIAL POINT

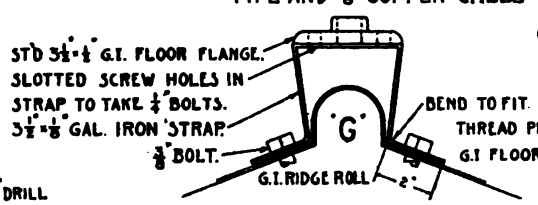


FULL SIZED DETAIL OF G.I. WEDGE USED IN ½" PIPE COUPLING IN CONNECTION BETWEEN PIPE AND ⅜" COPPER CABLE



DETAIL OF AERIAL POINT ON GABLE END.



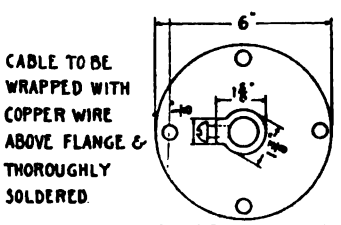


DETAIL OF SUPPORT FOR GABLE END AERIAL POINT

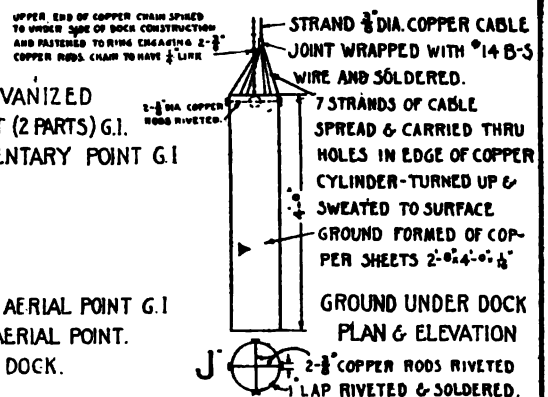
NOTES

ALL IRON TO BE HOT GALVANIZED

A. SUPPLEMENTARY POINT (2 PARTS) G.I.
B. SUPPORT FOR SUPPLEMENTARY POINT G.I
C. GROUND
D. CABLE SUPPORT G.I
E. AERIAL POINT ½" G.I
F. WEDGE G.I.
G. SUPPORT FOR GABLE END AERIAL POINT G.I
H. CAST IRON CAP FOR MAIN AERIAL POINT.
J. GROUND FOR USE UNDER DOCK.



PLAN AND SECTION OF MAIN AERIAL POINT ON VENTILATORS WITH SUPPORT FOR SAME.


UPPER END OF COPPER CHAIN SPIKED TO UNDER SIDE OF DOCK CONSTRUCTION AND FASTENED TO RING ENGAGING 2-⅜" COPPER RODS. CHAIN TO HAVE ½" LINK
STRAND ⅜" DIA. COPPER CABLE
JOINT WRAPPED WITH #14 B-S WIRE AND SOLDERED.
2-⅜" DIA COPPER RODS RIVETED
7 STRANDS OF CABLE SPREAD & CARRIED THRU HOLES IN EDGE OF COPPER CYLINDER-TURNED UP & SWEATED TO SURFACE
GROUND FORMED OF COPPER SHEETS 2'-0"×4'-0"×⅛"
GROUND UNDER DOCK PLAN & ELEVATION
J
2-⅜" COPPER RODS RIVETED
LAP RIVETED & SOLDERED.

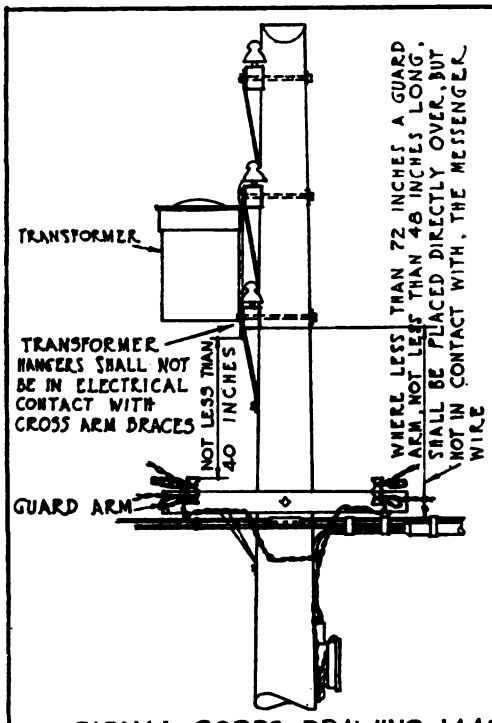
FOR ORIGINAL SEE DRAWING 652-134

CONSTRUCTION DIVISION OF THE ARMY

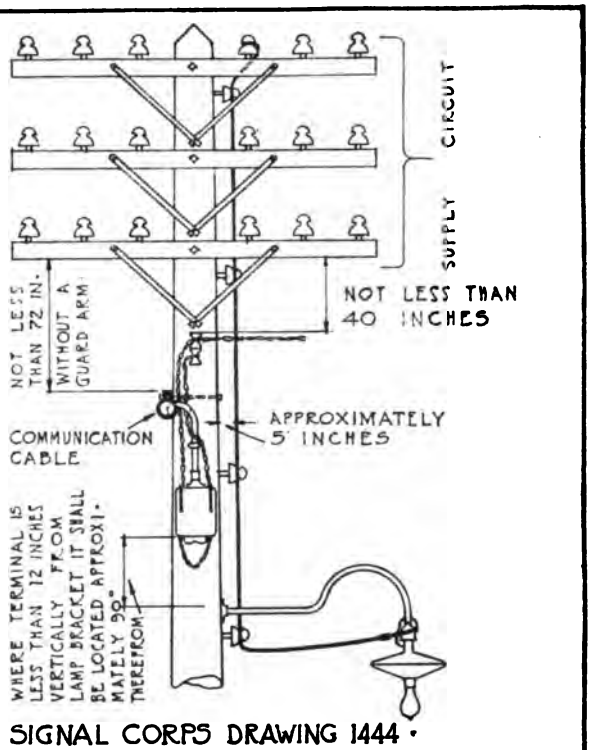
PROTECTION OF BUILDINGS FROM LIGHTNING

DETAILS OF APPARATUS

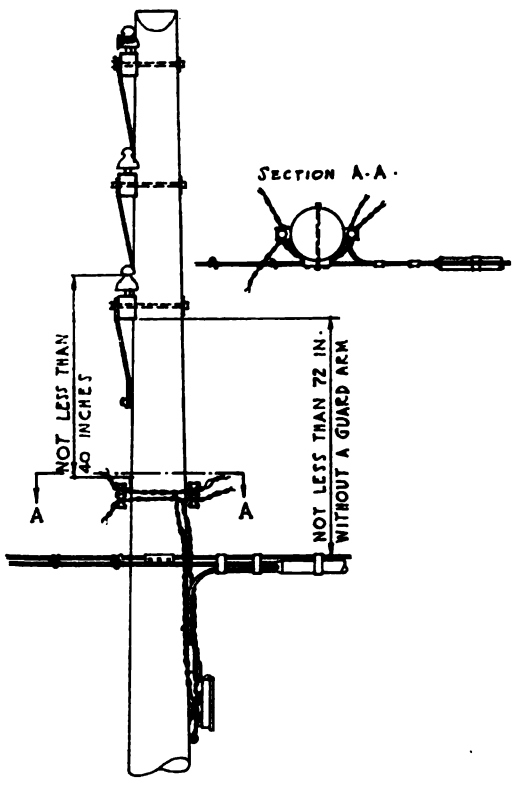
ORDNANCE STOREHOUSES


TRANSFORMER
TRANSFORMER HANGERS SHALL NOT BE IN ELECTRICAL CONTACT WITH CROSS ARM BRACES
NOT LESS THAN 40 INCHES
GUARD ARM
WHERE LESS THAN 72 INCHES A GUARD ARM, NOT LESS THAN 48 INCHES LONG, SHALL BE PLACED DIRECTLY OVER, BUT NOT IN CONTACT WITH, THE MESSENGER WIRE

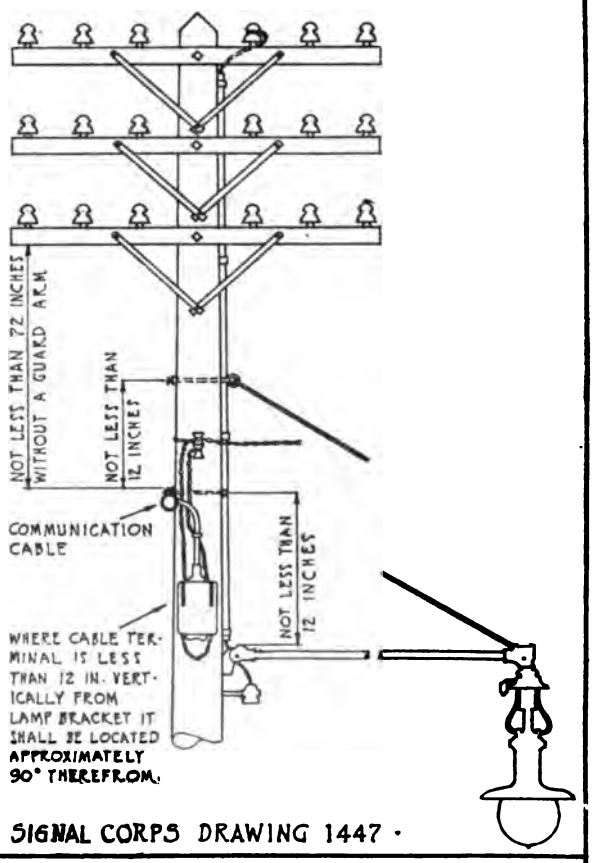
· SIGNAL CORPS DRAWING 1443 ·


SUPPLY CIRCUIT
NOT LESS THAN 40 INCHES
NOT LESS THAN 72 IN. WITHOUT A GUARD ARM
APPROXIMATELY 5" INCHES
COMMUNICATION CABLE
WHERE TERMINAL IS LESS THAN 12 INCHES VERTICALLY FROM LAMP BRACKET IT SHALL BE LOCATED APPROXIMATELY 90° THEREFROM

· SIGNAL CORPS DRAWING 1444 ·

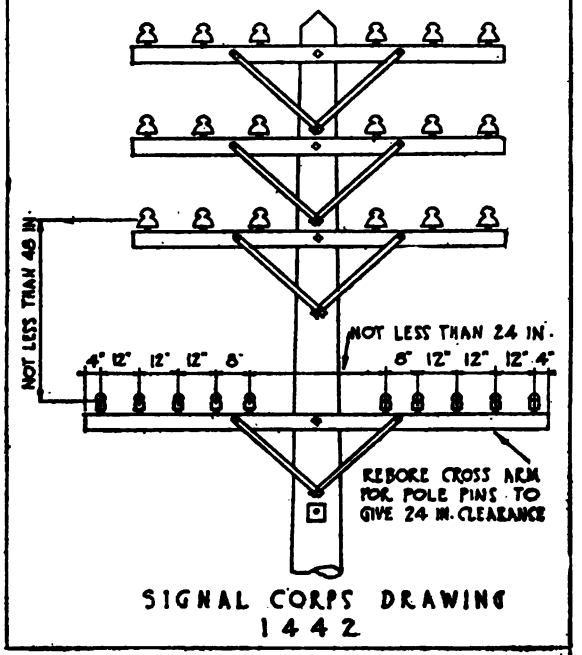


· SIGNAL CORPS DRAWING 1448 ·


NOT LESS THAN 72 INCHES WITHOUT A GUARD ARM
NOT LESS THAN 12 INCHES
COMMUNICATION CABLE
NOT LESS THAN 12 INCHES
WHERE CABLE TERMINAL IS LESS THAN 12 IN. VERTICALLY FROM LAMP BRACKET IT SHALL BE LOCATED APPROXIMATELY 90° THEREFROM.

· SIGNAL CORPS DRAWING 1447 ·

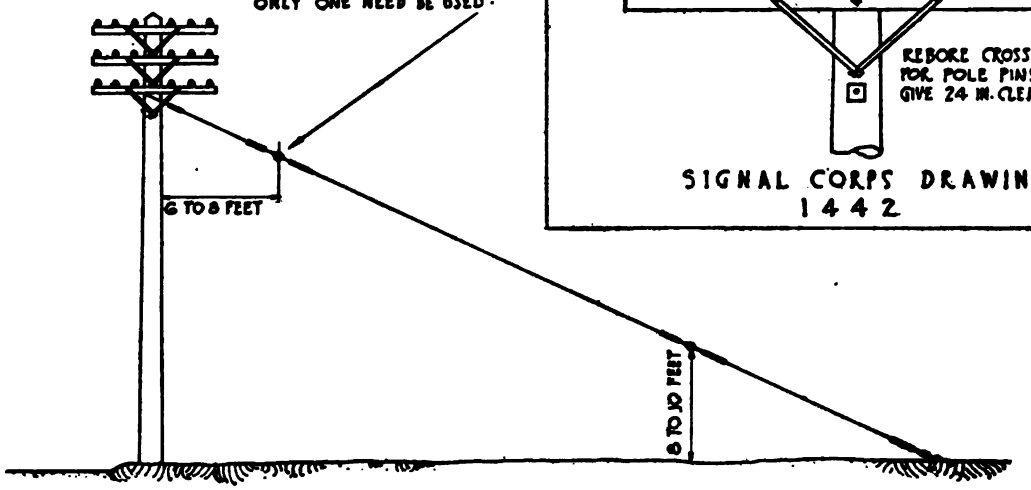
CONSTRUCTION DIVISION OF THE ARMY
CONSTRUCTION ON POLES JOINTLY USED FOR SUPPLY & COMMUNICATION CIRCUITS



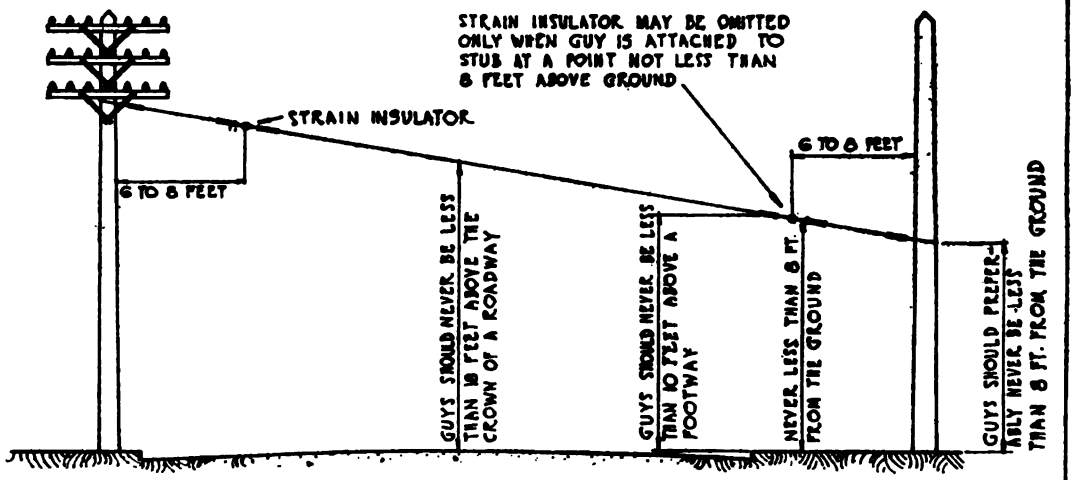
SIGNAL CORPS DRAWING 1442

GUY SHALL CLEAR LINE CONDUCTORS ON GUYED POLE BY NOT LESS THAN 4 INCHES.

WHERE THE TWO STRAIN INSULATORS HERE REQUIRED WOULD BE LOCATED WITHIN 5 FEET OF EACH OTHER, ONLY ONE NEED BE USED.



· SIGNAL CORPS DRAWING 1446 ·


STRAIN INSULATOR MAY BE OMITTED ONLY WHEN GUY IS ATTACHED TO STUB AT A POINT NOT LESS THAN 8 FEET ABOVE GROUND
STRAIN INSULATOR
6 TO 8 FEET
6 TO 8 FEET
GUYS SHOULD NEVER BE LESS THAN 18 FEET ABOVE THE CROWN OF A ROADWAY
GUYS SHOULD NEVER BE LESS THAN 10 FEET ABOVE A FOOTWAY
NEVER LESS THAN 8 FT. FROM THE GROUND
GUYS SHOULD PREFERABLY NEVER BE LESS THAN 8 FT. FROM THE GROUND

· SIGNAL CORPS DRAWING 1445 ·

CONSTRUCTION DIVISION OF THE ARMY
CONSTRUCTION ON POLES JOINTLY USED FOR SUPPLY & COMMUNICATION CIRCUITS

PLUMBING AND HEATING.

PLUMBING.

PRELIMINARY NOTES:

These instructions are not to be considered as adequate specifications, for materials to be furnished or for work to be done, under the lump sum contract. They are intended to serve in connection with the emergency form of contract, which was adopted to enable work in the field to proceed immediately, without the necessity of waiting for detailed drawings.

Detailed specifications for use in connection with lump sum contracts, and schedules of fixtures and materials required for each standard building, with brief specifications of the grades of materials to be used, may be obtained upon application to the Washington office.

For permanent buildings located at posts on Government Reservations, or elsewhere, plumbing installations should meet the best standard practice as usually found in city regulations. Such installations should conform to requirements of "Plumbing Specifications for the Treasury, War and Navy Departments," which has been prepared as a standard for permanent work.

For temporary buildings constructed under emergency requirements, the plumbing installations should be such as to safeguard health, but in the most economical manner as to design and use of materials.

Standard methods and materials have been adopted for temporary construction, as shown on Plate No's 132-133 and on drawings showing lavatories, baths, kitchens and other Cantonment buildings, many of which are included as plates in this Manual.

FIXTURES:

Fixtures for hospitals should be in accordance with requirements given on S. G. O. Sheet No. 7-Z1, in the files of the Construction Division. They are generally of hospital design where required for surgeons and utility uses and of the best grade of vitreous, porcelain or stone-ware for sinks, lavatories, and slop sinks.

Fixtures to be used for emergency work should be selected or designed to provide for rapid and economical construction, as follows:

Water Closets, should be of the wash-down type, with low enameled or porcelain tanks and wood seats, as described on Plate No. 132. Such closets should be installed in buildings used for toilet purposes only. The number of men that one closet will accommodate, varies with the size of the unit to be furnished. In officers' toilets, or for small units, one closet to eight men is a generous allowance. In the standard lavatory buildings, one closet is provided for from thirteen to fifteen men.

Notes: In Hospital construction, wash-down syphon action water-closets should be installed. Where toilets are concentrated and runs of the water piping are not excessive, the closets should

be equipped with good grade of closet flush valves. One water-closet should be provided for each fifteen to eighteen beds in wards and one water-closet for each sixteen men in barracks.

Urinal Troughs, should be constructed of reinforced galvanized sheet steel, see Plate No. 132. Such urinals should be installed in buildings used for toilet purposes only and not in buildings to be used for sleeping purposes.

Note: In Hospitals and in buildings used for sleeping purposes, urinals installed should be enameled iron troughs, equipped with integral backs, loose key stops and perforated flush pipes.

Lavatory Troughs, should be installed in conjunction with galvanized steel urinal troughs, the waste from lavatories being arranged for flushing the urinals. The troughs should be of galvanized sheet steel constructed and equipped as shown and described on Plate No. 132.

Galvanized Sanitary Drinking Fountain, should be provided for each lavatory building, and in special cases such fountains are provided in shops and hospitals.

Cast Iron Drains, with trapped outlets and sand pockets, should be provided where shown in lavatories.

Shower Heads, should be of rough brass, about 4-inch face, with small water supply openings to emit sprays seven or eight inches in diameter. There should be provided one shower head for each fifteen to twenty-two men. The water supply should be galvanized iron pipe with angle stop valve control overhead.

Steel Storage Tanks and Cast Iron or Steel Heaters, with coal burning grates, should be installed to provide hot water for showers; also to supply one faucet for each lavatory building, sinks and other requirements, as needed. The storage tanks should be of capacity to store from two and one-quarter to four gallons of water per man in shower buildings and the heaters should be of sufficient size to heat full capacity of tank from 50 degrees to about 180 degrees in about five hours.

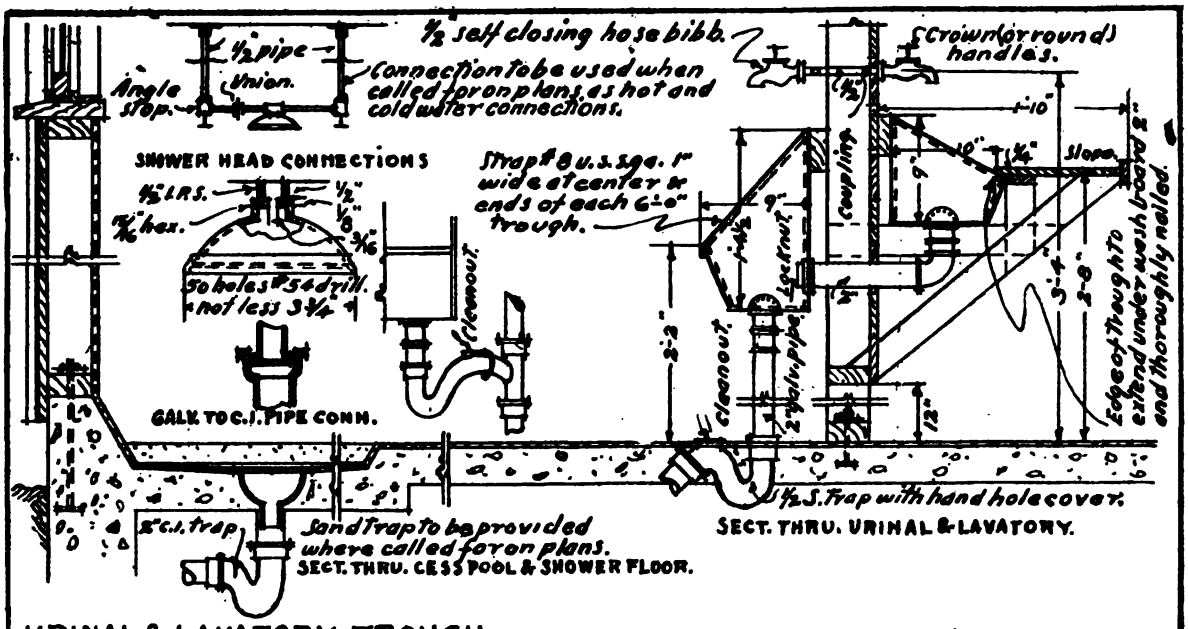
PIPING:

Consideration should always be given in the field, to locations of buildings with reference to sewer and water mains, as these details govern the direction and runs for the branch piping. In most cases the standard drawings can easily be adapted to apply to any local condition.

For emergency construction, the policy should be to provide the soil and waste lines with only such vertical vent lines, as are necessary to prevent the syphonage of traps at the plumbing fixtures. The use of S-traps with long drop legs into horizontal runs of pipes, should be avoided. Local or trap venting is not necessary nor is it required.

Soil, Waste and Vent Piping in connection with temporary construction should be of standard weight hub and spigot cast iron, with full caulked joints of lead and oakum. Branches and turns should be made with quarter bends or sanitary fittings.

Floor Flanges, for plumbing fixtures in temporary buildings, should be cast iron, caulked to soil pipe, with brass floor bolts and screws at fixture. Small waste lines should be provided with P or running traps with cleanouts. Floor drains should be provided, only where indicated, with bell traps of special sand trap pattern. In general, these floor drains provide the only means


½" self closing hose bibb.
(Crown (or round) handles.
½" pipe
Union.
Angle stop.
Connection to be used when called for on plans, as hot and cold water connections.
SHOWER HEAD CONNECTIONS
½" I.P.S.
13/16" hex.
50 holes #54 drill. not less 3¼"
Strap #8 U.S. std. 1" wide at center & ends of each 6'-0" trough.
Cleanout
Coupling
Slope
Edge of trough to extend under wash board 2" and thoroughly nailed.
Cleanout
2" Soil pipe
Outlet
12"
CALK TO C.I. PIPE CONN.
2" C.I. trap
Sand trap to be provided where called for on plans.
SECT. THRU. CESS POOL & SHOWER FLOOR.
1½" S. Trap with hand hole cover.
SECT. THRU. URINAL & LAVATORY.

URINAL & LAVATORY TROUGH.

METAL TROUGH TO BE #24 U.S.S. GAUGE GALV. IRON. CONTINUOUS #8 U.S.S. GA. BLACK IRON REINFORCING BAR RIVETED 6" O.C. PAINTED 1-COAT OF LEAD & OIL, TO BE FOLDED IN TO EDGES AT FRONT AND ENDS. END SEAMS TO BE DOUBLED LOCKED, HAMMERED FLAT AND SOLDERED, ENDS TO BE TAPERED SUFFICIENTLY TO ALLOW FOR NESTING IN SHIPMENT. TO OBTAIN FALL, GRADE WOOD SUPPORT AT BACK ⅛" TO A FOOT.

URINAL OUTFIT.

CONSISTS OF ONE TROUGH APPROX. 6'-0" LONG, 1-½" ROUGH BRASS SELF CLOSING HOSE BIBB WITH MALE THREAD, 2" BRASS PLUG WITH BEEHIVE STRAINER, GASKET, BRASS LOCK NUT 4" LONG BRASS TAIL PIECE & COUPLING WITH FRICTION RING 2" GALV. PIPE WITH SLIP NUT TO RUN TO HUB AT FLOOR LINE TO CAULK INTO 2" HUB OF TRAP WITH CLEAN OUT. LOCATION OF WATER TO BE AS SHOWN ON LAVATORY DETAIL

LAVATORY OUTFIT

CONSISTS OF ONE TROUGH OF LENGTH SHOWN ON PLANS, PROVIDED WITH WASTES AT POINTS INDICATED ON PLANS. WASTE TO BE COMPLETE AS SHOWN, WITH 2" BRASS PLUG, BEEHIVE STRAINER, GASKET, BRASS LOCK NUT, COUPLING AND 2" TAIL PIECE, WITH 2" I.P. THREADED BRASS BUSHING ON SAME. TAIL PIECE AND BUSHING TO BE 2" LONG OVER ALL. 1-2" GALV. ELL WITH LOCK NUTS, NIPPLE AS SHOWN ON PLAN. 1-½" ROUGH BRASS SELF CLOSING BIBB, WITH MALE THREAD, TO BE FURNISHED FOR EACH 2'-0" OF TROUGH LENGTH.

CLOSET OUTFIT.

CONSIST OF 1-VITREOUS WASH DOWN SYPHON ACTION BOWL, RUN OF KILN, WITH 2½" SEAL, 2" BRASS SPUD & TO ROUGH-IN AT 14" ONE HARDWOOD SEAT WITHOUT COVER SEAT TO BE MADE FROM 1¼" STOCK, REINFORCED AND FINISHED WITH 1 COAT OF SHELLAC & 2 COATS OF VARNISH AND FITTED WITH N.P. CAST BRASS BAR HINGE & N.P. BRASS SCREW. SEAT TO BE OPEN FRONT TYPE. 1-VITREOUS CHINA, RUN OF KILN, OR ENAMELED INSIDE & OUT, C.I. TANK, BALL COCK, BRASS ROD & FLOAT & FITTED ⅜" I.P. TAIL PIECE, 1-RUBBER BALL, BRASS FLUSH VALVE. WITH OVER FLOW, 2" N.P. BRASS ELL, TOP SIDE DOUBLE ACTING LEVER, 1-2½" DEEP C.I. CLOSET FLANGE, WITH IRON BOLTS AND BRASS NUTS.

SHOWER OUTFIT.

CONSISTS OF 1-4" ROUGH CAST BRASS SHOWER HEAD WITH REMOVABLE FACE, AND 2-½" ROUGH BRASS COMPRESSION ANGLE STOPS. SHOWER HEAD TO WEIGH AT LEAST 16 OZ. FACE PROVIDED WITH LUGS OR FLARED FLANGE GRIP. HEAD TO USE NOT OVER 3 GALLONS OF WATER PER. MIN. AND TO HAVE A 7" SHOWER SPREAD 12" BELOW FACE WITH 30# WATER PRESSURE OR 8" SPREAD WITH 40# PRESSURE.

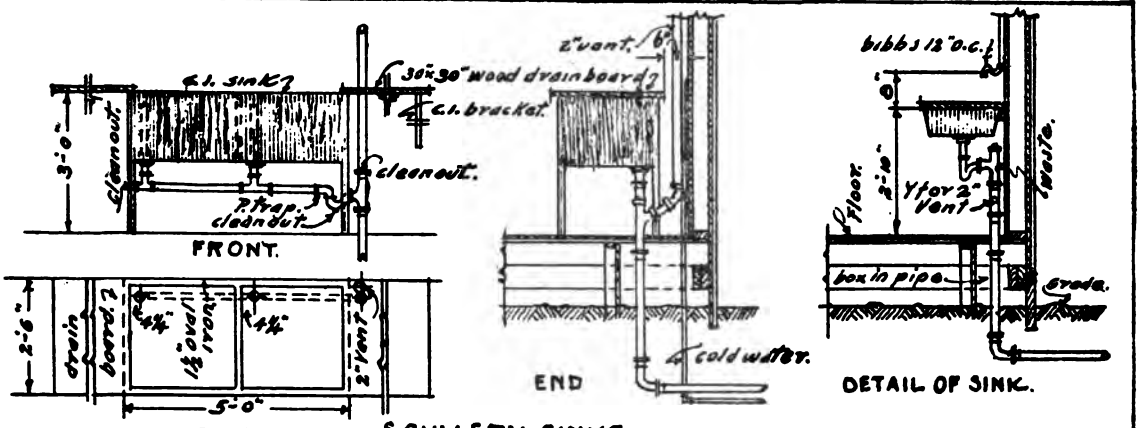
PIPE FITTING & VALVES.

ALL SOIL OR WASTE PIPES AND FITTINGS TO BE C.I. STD WEIGHT, PLAIN OR TARRED. ALL FITTINGS AND PIPES FOR WATER SYSTEM TO BE GALV. ALL VALVES FOR SHOWERS TO BE ½" ROUGH BRASS COMP. ANGLE VALVES WITH IRON WHEEL. ALL VALVES IN WATER LINE TO BE ROUGH BRASS GATE VALVES WITH IRON WHEEL.

REFRIGERATOR DRAINS.

DRAIN PIPES ARE TO BE PROVIDED FROM ALL REFRIGERATORS & ICE BOXES, CONN. TO WASTES INTO NEAREST SINK, OPEN CATCH BASIN OR SUMP. WHERE NECESSARY TO CONN. TO SEWER, AN APPROVED REFRIGERATOR FLOOR DRAIN IS TO BE INSTALLED WITH HINGED TRAP COVER AND CONNECTED TO WASTE LINE FROM SINK, BASINS OR DRINKING FOUNTAINS ONLY.

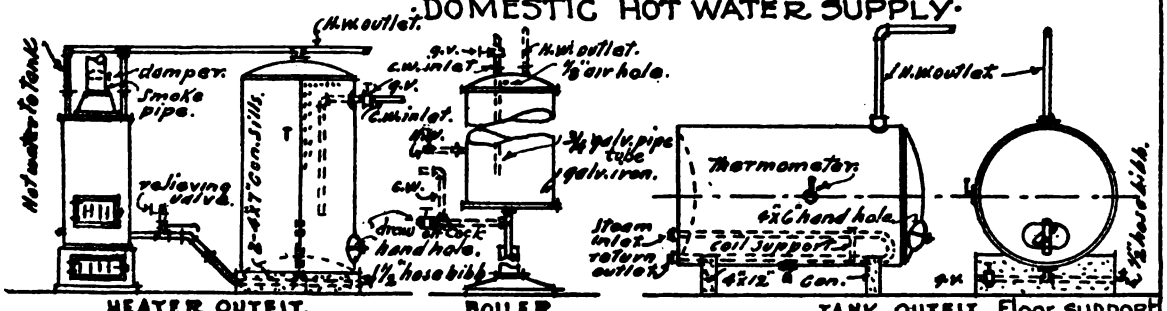
CONSTRUCTION DIVISION OF THE ARMY
TYPICAL PLUMBING
URINALS · LAVATORIES · WATER CLOSETS, ETC



SCULLERY SINKS

SINKS 60"x30"x16" DIVIDED INTO TWO COMPARTMENTS. SINKS CONST OF #12 U.S.S. GUAGE GALV. IRON, 1½" FLANGE AT TOP TO WHICH IS RIVETED A 1½" GALV. HALF OVAL BAND. PARTITION DIVIDING SINK INTO TWO EQUAL COMPARTMENTS CONST OF #12 GALV. IRON FLANGED AND RIVETED TO SIDES AND BOTTOM OF SINK AND BORDERED ON EACH SIDE OF TOP WITH 1" GALV. HALF OVAL IRON. LEGS MADE OF 1½" GALV. ANGLE IRON, RIVITED TO SINK WITH SAME RIVETS AS USED IN RIVITING SIDES. JOINTS RIVITED COLD AND CAULKED WATER TIGHT. CORNERS LOADED WITH SOLDER. EACH COMPARTMENT TO HAVE A 2½" HOLE IN BOTTOM NEAR BACK; CNTR. 4¼" FROM L. SIDE, BUMPED OUT TO TAKE A 4½" FEATHER EDGE FLANGE. SINK FURNISHED WITH 2" ROUGH BRASS CONNECTED WASTE MADE UP OF THE FOLLOWING MATERIALS. 1-2" BRASS P. TRAP. 1-2x6 FINE THREAD NIPPLE, THREADED ONE END, 2-2x30 FINE THREAD NIPPLE THREADED ONE END, 2-2x2 SINGLE SLIP FINE THREAD T.Y. 1-2x2 DOUBLE SLIP FINE THREAD T.Y. 2-2" FINE THREAD PLUG. SINK OUTFIT FOR KITCHEN LESS THAN 30 MEN, CONSISTS OF 1-20"x40" FLAT RIM IRON SINK SUPPORTED ON WOODEN FRAME. SINK PROVIDED WITH STRAINER PLUG WITH 1½" TAIL AND 1½" TRAP, 1-½" COMPRESSION BRASS PLAIN BIBB, 1-½" COMP. BRASS HOSE BIBB. SINK TRAP CONNECTED TO 2"x1½" TAPPED T.Y. CLEAR OF SINK, SO CLEAN OUT MAY BE REMOVED FOR CLEANING WASTE PIPE.
SINK TO HAVE A 20"x30" WOODEN DRAIN BOARD WITH 20" IRON BRACKET SET TO SUPPORT THE DRAIN BD.

DOMESTIC HOT WATER SUPPLY.



OUTFIT NUMBER.	30	100	150	200	300	400
HEATER. (WATER RAISED FROM 50° TO 160°						
CAP. GAL'S. PER. HOUR.	60	120	180	200	300	400
MIN. DIA. FIRE POT.	10"	12"	12"	15"	18"	20"
NUMBER & SIZE FLOW OPG'S	1-1½"	1-1½"	2-1½"	2-2"	2-2"	2-2"
" " " RET. OPG'S	1-1½"	1-1½"	2-1½"	2-2"	2-2"	2-2"
MIN. WT. OF HEATER LBS.	200	280	400	520	775	840
TANK.						
CAPACITY IN GALLONS.	120	180	265	360	470	560
MAX. LENGTH INCHES.	60	60	60	60	60	72
SIZE OF ALL CIRC'L'G. CONN.	1½"	1½"	1½"	2"	2"	2"
APPROX. WT. POUNDS.	480	500	700	800	1200	1400

BOILER.		
CAPACITY IN GALLONS.	DIAM.	LENGTH.
30	12"	5'-0"
40	14"	5'-0"
50	16"	5'-0"
66	18"	5'-0"
82	20"	5'-0"
100	22"	5'-0"

OUTFIT NUMBER.	50	100	150	200	300	400
CAP. GALLONS.	120	180	265	360	470	560
MAX. LENGTH	48"	60"	84"	84"	84"	84"
SIZE OF WATER CONNECTIONS.	1"	1"	1¼"	1¼"	1½"	1½"
APPROX. WT. OF TANK EXCL. COIL.	400	500	700	800	1200	1400
LENGTH & SIZE OF PIPE COIL.	8-1¼"	14-1¼"	14-1½"	18-1½"	22-1½"	36-1½"

RANGE BOILERS.

RANGE BOILERS AS CALLED FOR ON PLANS WITH 4-1" TAPPINGS. C.W. SUPPLY TO HAVE TUBE. C.W. SUPPLY TO BOILERS HAVE ¾" I.S. GATE VALVE. CIRCULATING CONNECTIONS BETWEEN WATER BACKS OR HEATERS & RANGE BOILERS TO BE 1" ½" DRAW OFF BIBB FOR EACH RANGE BOILER OR BATTERY OF BOILERS ON END OF COLD WATER CONN. TO WATER BACKS.

FOR ORIGINAL, SEE DRAWING. 620-351-352.

CONSTRUCTION DIVISION OF THE ARMY
SCULLERY SINK, SINKS & HOT WATER SUPPLY
FOR TYPICAL BUILDINGS

of cleaning the horizontal lines except by removal of fixtures. The use of small grease traps has been abandoned and this detail is provided for in connection with sewage collection and disposal, see Plates 38A, 39 and 40.

Piping for Roof Drainage, of emergency buildings is not generally provided. Buildings with roofs of saw-tooth construction, or roofs which cover a large area and require inside rain leaders, should be provided with cast iron verticals from grade, connecting with standard type of roof flanges which have enlarged openings, strainers and connections for caulking. Pipes below grade, may be of vitrified pipe. For vertical lines, 3 inch pipe will drain 1600 square feet, 4 inch pipe will drain 3100 square feet and 6 inch pipe will drain 8000 square feet. For horizontal runs, having a fall of ¼ inch per foot, these areas should be reduced 30 per cent for same pipe sizes.

Requirements for conservation of materials, have led to the use of 3 inch vertical vent lines for sanitary drains where 4 inch were formerly used; 3 inch pipes are considered sufficient for venting small units, provided 4 inch pipes are carried through the roofs. The sizes of horizontal runs of soil and waste lines are based on using a 4 inch line, to drain sixteen or less water-closets (or the equivalent in three 2 inch traps to one water-closet) and a 6 inch line up to forty-eight closet wastes. Where lines are buried and where vitrified pipe is used, larger sizes have been adopted, and are generally shown on special drawings when required.

Water Piping, may be either galvanized iron or steel with galvanized malleable fittings. Protection of supply mains against freezing, should always be considered and provided. It is not possible to make economical layouts of water piping on standard drawings, nor to specify fixed requirements as to sizes, as relative locations of water mains and of hot water supplies are not always the same. For this reason, arrangements of piping in buildings, should be designed in the field, in a definite and economical way before installation is begun.

Branches to fixtures should be generally ½ inch, except for hose connections, slop sinks, laundry and kitchen sinks, which should be ¾ inch. The fixing of standard sizes to give economical results is not practicable, as in a location with high water pressure and water of good quality, sizes can be much smaller than in localities where pressure is low or deposits of solids in the pipe lines are excessive.

KITCHENS AND BAKERIES.

NOTE:

The general information contained under this heading or on the Plates pertaining to this subject, are not to be considered as adequate specifications for materials to be furnished or for work to be done. Standard kitchen and cafeteria plans have been prepared, describing types and showing locations of necessary equipment and are available upon application to the Washington office. Before actual work is begun on any standard layout, consideration must be given to existing conditions and necessary modifications should be made in general conformity with the established designs.

KITCHEN CLASSIFICATION:

Kitchens are classified as follows: (1) Standard Cantonment; (2) Hospital and Miscellaneous.

STANDARD CANTONMENT KITCHENS:

A Standard Kitchen, is equipped with one or two ranges and hot water boiler, work sink with drain-boards and refrigerator. Capacities and equipment, including ranges and hot water boilers, for kitchens of various sizes, are given on Sheet No. 620-316, in the files of the Construction Division.

Ranges for Cantonment Kitchens, are of heavy steel plate construction furnished with water-backs or water-fronts, cast iron fire-box linings and without shelves.

Ranges can be obtained in capacities capable of serving up to 125 men each. The rating of ranges is expressed in terms of the number of men served and is based upon the top cooking surface and the oven volume. For installation of ranges, see Sheet Nos. 620-329 and 330 in the files of the Construction Division and Plate No. 147.

The smallest range specified by this office is capable of cooking for twenty men; the top cooking surface of this range is approximately 28 inches by 34 inches, and the oven is approximately 18 inches wide by 12 inches high and 20 inches deep.

The range most generally specified for kitchens serving barracks, is capable of cooking for 125 men and when two of these ranges are placed in a battery, they will serve from 250 to 300 men. The top cooking surface of this range is approximately 36 inches by 55 inches, and the oven is approximately 30 inches wide by 16 inches high and 24 inches deep.

Refrigerators for Cantonment Kitchens, are built in sections with all parts interchangeable and constructed so that they can be put together without boring a single hole. Specifications for refrigerators, may be obtained from the Standardization Section of the Purchase, Storage and Traffic Division of the General Staff, according to the following:

TABLE OF SIZES AND CAPACITIES:

Size (inches)	Capacity (Men Provided for)	Standard Specification Number
30 x 19¼ x 40	1- 5	G. S. 840
38½ x 25 x 58	6- 15	G. S. 830
44½ x 28¼ x 66	16- 40	G. S. 820
54 x 30 x 90	41-100	G. S. 810
60 x 42 x 94	101-280	G. S. 800

A tabulation of refrigerators to be used, giving sizes and capacities, for the standard Cantonment Buildings, are listed on Sheet No. 620-535, in the files of the Construction Division.

HOSPITAL MESS AND KITCHENS:

Hospital mess and kitchens are equipped to care for three types of service, all of which may be used in connection with one kitchen at the same time. Types of service are as follows:

(a) Set-up Mess, is service direct, from the kitchen serving table, or counter in mess hall.

(b) Cafeteria Service, is from counter in connection with kitchen.

Men, on entering, are served from the serving counter and when passing out deposit their soiled dishes, etc., in the dish-washing pantry. This pantry should connect, if possible, with the

· STANDARD KITCHEN EQUIPMENT FOR HOSPITALS, CAFETERIAS, ETC. · CAPACITY 25 TO 5000 ·

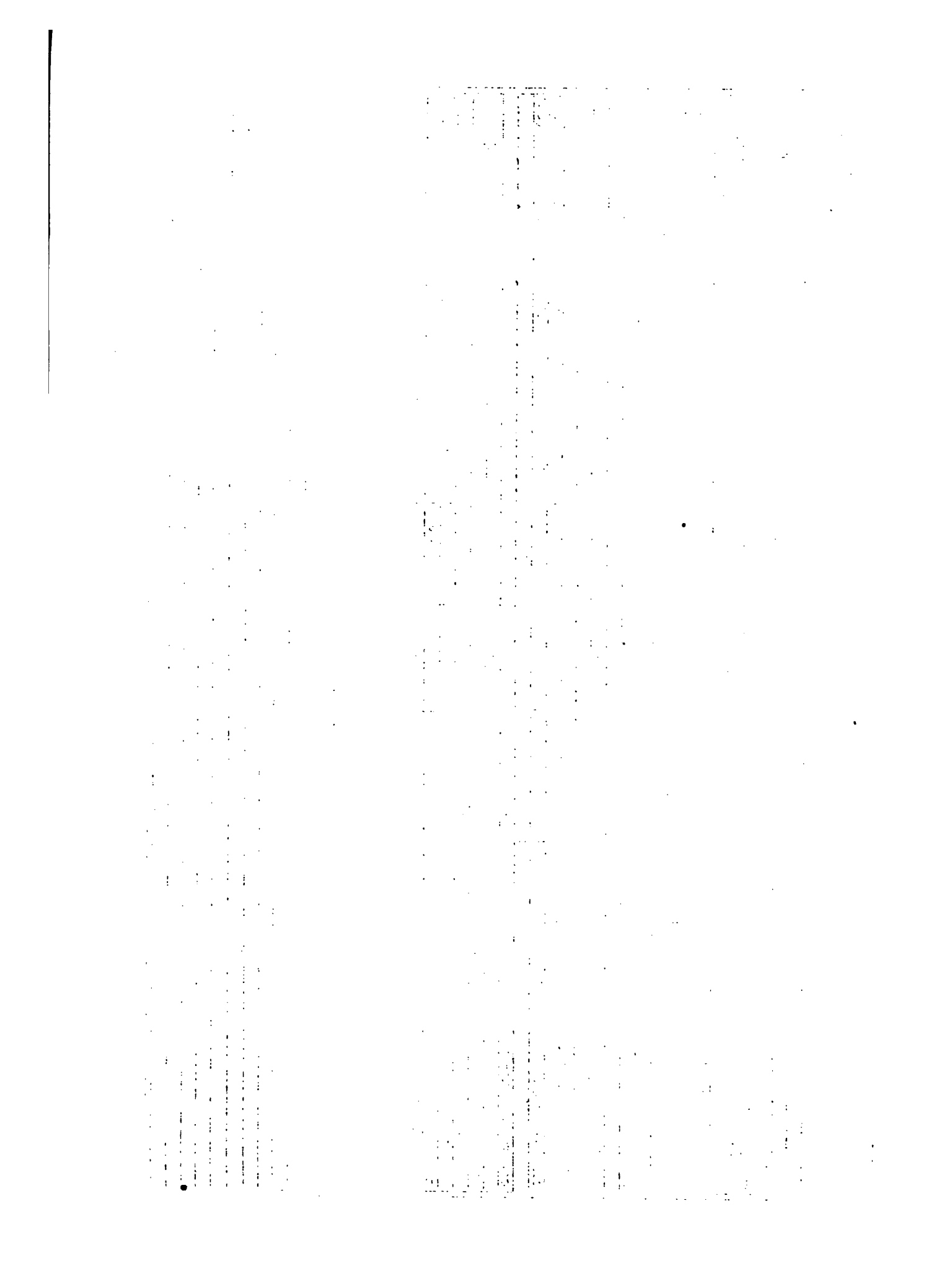
FIXTURES	SIZE	CONNECTIONS TO FIXTURES: STEAM S.	STEAM R.	WATER H.	WATER C.	WATER W.	ELEC. H.P.	FLOOR SPACE REQUIRED	CAPACITY (MEN) 25-50	50-100	100-200	200-300	300-500	500-750	750-1000	1000-1500	1500-2000	2000-3000	3000-4000	4000-5000
REFRIGERATOR · OVER ALL									4'6"x2'6"x7'6"	4'6"x2'6"x7'6"	6'x6'x11"	10'x6'x11"	16'x10'x11"	16'x10'x11"	23'x9'x11"	26'x11'x11"	26'x11'x11"	29'x13'x11"	29'x13'x11"	29'x13'x11"
MEAT COMPARTMENT												6'	8'	8	7'·8"	12'·3"	12'·3"	14'·8"	14'·8"	14'·8"
VEGETABLE COMPARTMENT													4'	4'	7'	6'·2"	6'·2"	6'·2"	6'·2"	6'·2"
DAIRY												4'	4'	4	7'	6'·6"	6'·6"	6'·6"	6'·6"	6'·6"
RANGE · SECTION	4' & 5' SEC.							— x 3'·6"	U.S. 125	U.S. 125	2-(5')	3-(4')	4-(4')	4-(4')	6-(4')	6-(4')	6-(4')	6-(4')	8-(4')	10-(4')
BAKE OVEN	42"x32"x63"							42"x 32"										1	1	1
STEEL HOOD	—x4'·6" or 8'·6"								6'x4'·6"	6'x4'·6"	11'x4'·6"	15'x4'·6"	17'x4'·6" 5'x 8'·6"	17'x4'·6" 5'x 8'·6"	25'x 8'·6"	25'x 8'·6"	26'x 8'·6"	26'x 8'·6"	2·(17'x8'·6")	2·(21'x8'·6")
SAUCE PAN RACK									6'	6'	8'	10'	2-(7')	2-(8')	2-(10')	2-(10')	2-(10')	2-(10')	2-(12')	2-(12')
STEEL COOKS' TABLE	— x 3'							— x 3'	6'x3'	6'x3'	6'x3'	8'x3'	2{10'x3' 7'x3'	2{10'x3' 7'x3'	2{15'x3' 5'x3'	2(12'x3')	2(12'x3')	2-(12'x3')	2-(12'x3')	2-(12'x3')
COOKS TABLE SINK	16"x 20"x 10"			½"	½"	2					1	1	1	1	1	1	1	1	2	2
BAIN MARIE	30"x 36"	¾"	¾"					30"x 36"			1	1	1	1	1	1	1			
STEAM TABLES	— x 25"	2-¾"	2-¾"			1"		— x 25										1 (8 CONT)	2 (8 CONT)	2-(8 CONT)
STOCK KETTLES, GALS.	60	½"	½"	½"				3' x 3'					1	1	2	3	4	5	7	8
ROASTING KETTLES	100 - 130#	¾"	¾"					3'x 3'					1	1	2	3	4	5	7	8
VEG. BOILER & STEAMER-GALS	35	⅜"·½"	½"					3' x 30"					1	1	2	2	3	4	5	5
3 COMP VEG. STEAMER	3 COMP.	1"	¾"					3' x 3'								1	1	1	2	3
STEEL HOOD	— x 8'·6"															16'x8'·6"	12'x8'·6"	12'x8'·6"	21'x8'·6"	24'x8'·6"
WHIPPING MACHINE	40 TO 80 QT.						1	4'x 3'											1	1
COFFEE URNS, GALS.	5 TO 20	⅜"	⅜"							2-(4)	2-(8)	2-(10)	2-(20)							
WATER URN, GALS	8 TO 30	⅜"	⅜"	½"						8	12	15	30							
URN STAND & CUP WARMER	4' TO 5'	¾"	¾"					— x 2'		4'	4'·6"	5'								
INSTITUTION COFFEE URNS, GALS	30 UP	½"	½"	½"				30"x 30"						2-(30)	2 (40)	2 (60)	2 (60)	3 (60)	4 (60)	4 (60)
2-COMP. POT, SINK & D.D. 3'x30"	5'x 3'x 18"			2-½"	2-½"	2-2"		5'x3'+D.B.	3'x30"x16"	3'x30"x16"	1	1	1	1	1	1	1	1	1	2
POT TABLES	— x 3'							— x 3'					2-(6'x3')	2(6'x3')	2-(8'x3')	2(8'x3')	2-(8'x3')	2-(8'x3')	2-(8'x3')	4-(8'x3')
2 COMP. WORK SINK & DD. 30'x30'	5'x30'x16"			2-½"	2-½"	2-2"		5'x30"+D.D.	1	1			1	1	1	1	1	1	1	2
WORK TABLES	— x 3'							— x 3'				6'x 30"	12'x 3'	12'x 3'	2-(12'x3')	2-(12'x3')	2-(12'x3')	2-(12'x3')	3-(12'x3')	3-(12'x3')
MEAT CHOPPER	#16 & #18						#16-1 #18-2	4'x 2'			#16	#16	#16	#18	#18	#18	#18	#18	#18	2-(#18)
MEAT SLICER		SETS ON TABLE											1	1	1	1	1	1	1	1
BUTCHER BLOCKS	2'x2' OR 30'x30'							2'x2' OR 30'x30'			24"x24"	24"x24"	30"x30"	30"x30"	30"x30"	30"x30"	30"x30"	2-(30'x30')	2-(30'x30')	2-(30'x30')
BUTCHER BENCH	— x 24" OR 30"							—x 24" OR 30"			4'x 24"	4'x 24"	6'x 30"	6'x 30"	6'x 30"	6'x 30"	8'x 30"	8'x 30"	2-(8'x 30")	2-(8'x 30")
BUTCHER SINK	3'x 2'x 10"			½"	½"	2"		3'x 2'					1	1	1	1	1	1	1	1
FISH TABLE	5'x 2'							5'x 2'					1	1	1	1	1	1	1	1
FISH BOX	6'x3'x33"							6'x 3'					1	1	1	1	1	1	2	2
2-COMP. VEG. SINK & D.D.	5'x30'x16"			2-½"	2-½"	2-2"		5'x30"+D.D.			1	1	1	1	1	1	1	1	1	1
VEGETABLE PEELER					½"	3"	1	2'x 2'			25#	25#	40#	40#	40#	40#	60#	60#	60#	60#
VEGETABLE TABLES	— x 30"							— x 30"							8'x 30"	10'x 30"	10'x 30"	10'x 30"	12'x 30"	2-(12'x30")
ICE CREAM FREEZER-QTS.	25 & 40						2	5'x 30"			25	40	40	40	40	40	40	40	40	40
ICE CREAM BOX	12' x 26"							12'x 26"											1	1
ICE CHEST	6'x3'x36"							6'x 3'											1	1
BREAD SLICER		SETS ON TABLE														1	1	1	1	1

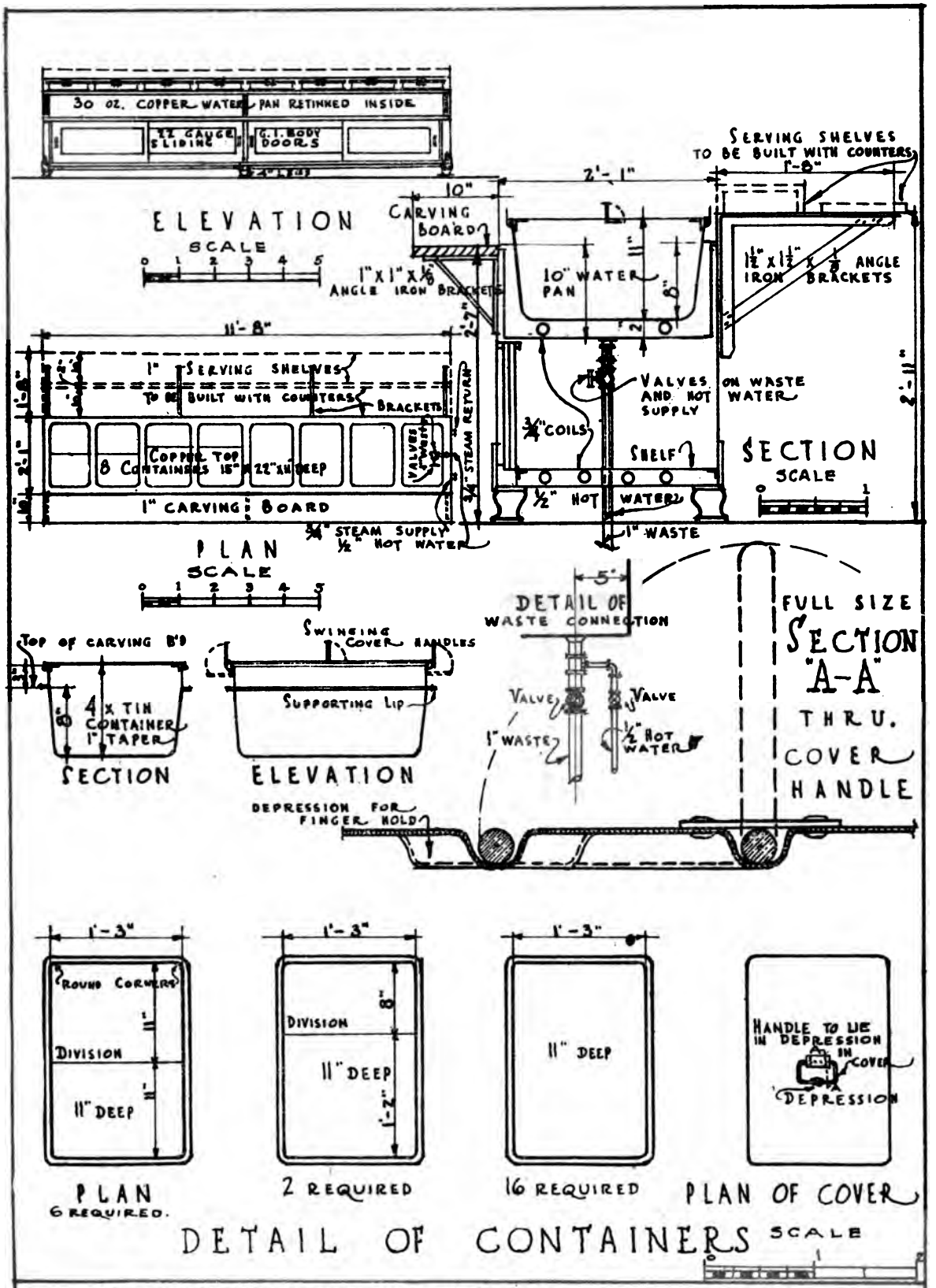
SECTION C. PLATE 134

· STANDARD KITCHEN EQUIPMENT FOR HOSPITALS, CAFETERIAS, ETC. · CAPACITY 25 TO 5000 ·

FIXTURES	SIZE	CONNECTIONS TO FIXTURES STEAM S	STEAM R	WATER H	WATER C	WATER W	ELEC H.P.	FLOOR SPACE REQUIRED	CAPACITY (MEN) 25-50	50-100	100-200	200-300	300-500	500-750	750-1000	1000-1500	1500-2000	2000-3000	3000-4000	4000-5000
SPECIAL DIETS;																				
RANGE	4'x5' SEC							-x3'-6"					5'	5'	5'	2-(4')	2-(4')	2-(4')	3-(4')	3-(4')
STEEL HOOD	-x4'-6" OR 6'-6"												6'x4'-6"	6'x4'-6"	6'x4'-6"	9'x4'-6"	9'x8'-6"	9'x8'-6"	15'x8'-6"	15'x8'-6"
SAUCE-PAN RACK													6'	6'	6'	8'	8'	8'	10'	10'
STEEL COOKS' TABLE	-x3'							-x3'					10'x3'	10'x3'	10'x3'	10'x3'	10'x3'	10'x3'	10'x3'	10'x3'
BAIN MARIE	30"x36"	¾"	¾"					2'-6"x3'										1	1	1
STOCK KETTLE - GALS.	40	½"	½"	½"				3'x3'					1	1	1	1	1	1	1	1
VEG. BOILER & STEAMER-GAL	35	¾"-½"	½"					3'x2'-6"									1	1	1	1
2-COMP. WORK SINK & DD 30"x30"	5'x30"x16"			2-½"	2-½"	2-2"		5'x2'-6"+D.D.					1	1	1	1	1	1	1	1
WORK TABLE	-x3'							-x3'										6'x3'	6'x3'	10'x3'
SMOKE & VENT PIPE																				
DISH WASHING ROOM													1	1	1	1	2	2	4	4
DISH WASHER	AA OR EE	½"		1"		2"	AA ½ EE 2	AA 2'-0"x2'-3" EE 4'-0"x3'-3"					AA	EE	EE	EE	2-(EE)	2-(EE)	4-(EE)	4-(EE)
2 COMP GLASS SINK	4'x2'x14"			2-½"	2-½"	2-2"		4'x2'					1	1	1	1	2	2	4	4
SOILED DISH TABLE	-x3'							-x3'					12'x3'	15'x3'	18'x3'	20'x3'	2-(10'x3')	2-(10'x3')	4-(10'x3')	4-(20'x3')
CLEAN DISH TABLE	-x3'							-x3'					10'x3'	12'x3'	15'x3'	18'x3'	2-(15'x3')	2-(15'x3')	4-(15'x3')	4-(18'x3')
COUNTER FIXTURES FOR CAFETERIA SERVICE																				
NO-SERVICE COUNTERS											1	1	1	1	1	1	2	2	4	4
STEAM TABLE	1-M 6-3 GAL	2-¾"	2-¾"			1"		4'-6"x2'-5"			1									
STEAM TABLE, LARGE CAP. CONT.	-x2'-5"	2-¾"	2-¾"			1"		6'-6", 11'-8"x2'-5"				4 CONT.	5 CONT.	5 CONT	8 CONT.	8 CONT.	2-(8 CONT)	2 (8 CONT)	4-(8 CONT)	4(8 CONT)
COFFEE URNS, GALS.	5 TO 20	⅜"	⅜"								2-8	2-10	2-10							
WATER URN, GALS.	8 TO 30	⅜"	⅜"	½"							12	15	15							
INSTITUTION COFFEE URN, GALS.	30 UP	½"	½"	½"				2'-6"x2'-6"						2-(30)	2-(30)	2-(40)	4-(40)	4-(40)	8-(30)	8-(40)
URN STAND & CUP WARMER	4' TO 5'	¾"	¾"					-x2'			4'-6"	5'	5'							
WHEN URNS ARE USED AT COUNTER CAFETERIA SERVICE, URNS IN KITCHEN FOR WARD SERVICE ARE REDUCED TO :-																				
COFFEE URNS, GALS.	10	⅜"	⅜"								OMIT	OMIT	2-(10)	2-(10)	2-(15)					
WATER URN, GALS.	15	⅜"	⅜"	½"							"	"	15	15	20					
URN STAND & CUP WARMER	5'	¾"	¾"					-x2'			"	"	5'	5'	5'					
INSTITUTION COFFEE URN-GALS.	30 UP	½"	½"	½"				2'-6"x2'-6"								1-(40)	1-(40)	2-(40)	2-(40)	2-(40)

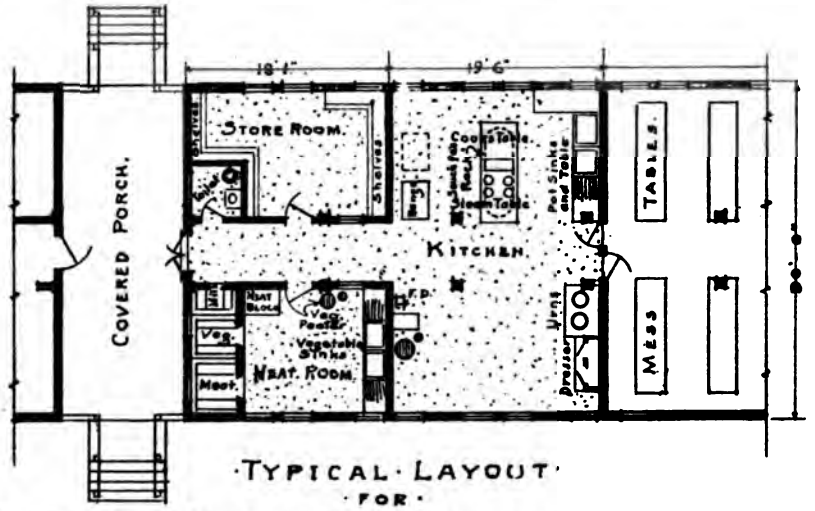
SECTION C. PLATE 135





CONSTRUCTION DIVISION OF THE ARMY

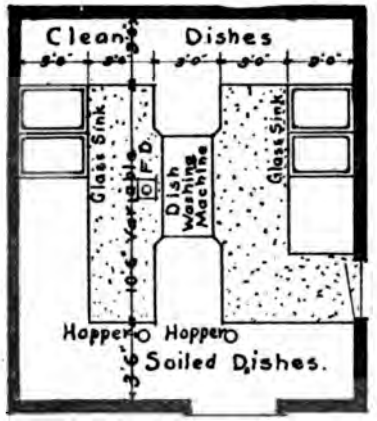
DETAILS FOR TYPICAL STEAM TABLE LARGE CAPACITY



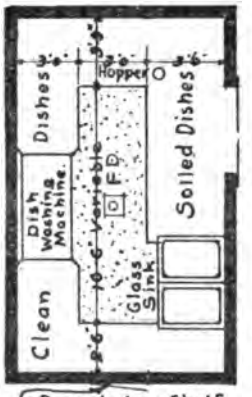
TYPICAL LAYOUT
FOR
NURSES' OR OFFICERS' KITCHEN AND MESS.

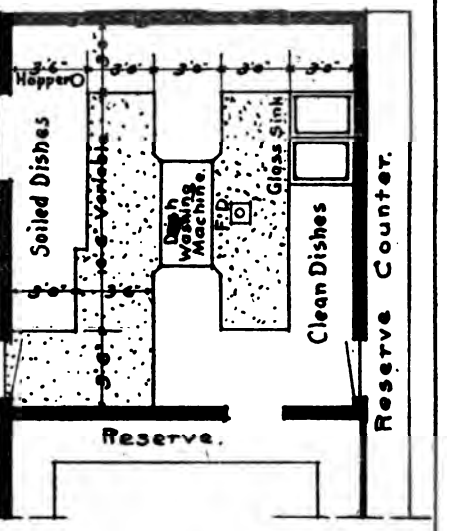
SCALE 0 5 10 15 20

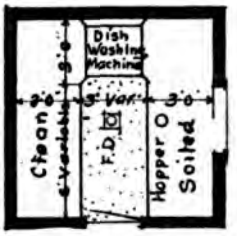
FOR ORIGINAL PLAN, SEE "SURGEON GENERAL'S OFFICE," SHEET 1 - D 11.

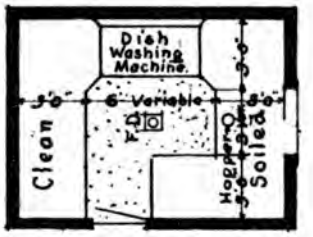


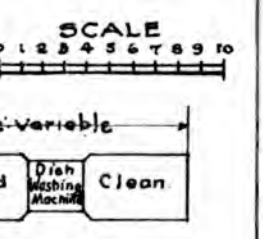
DOUBLE SERVICE ROOM





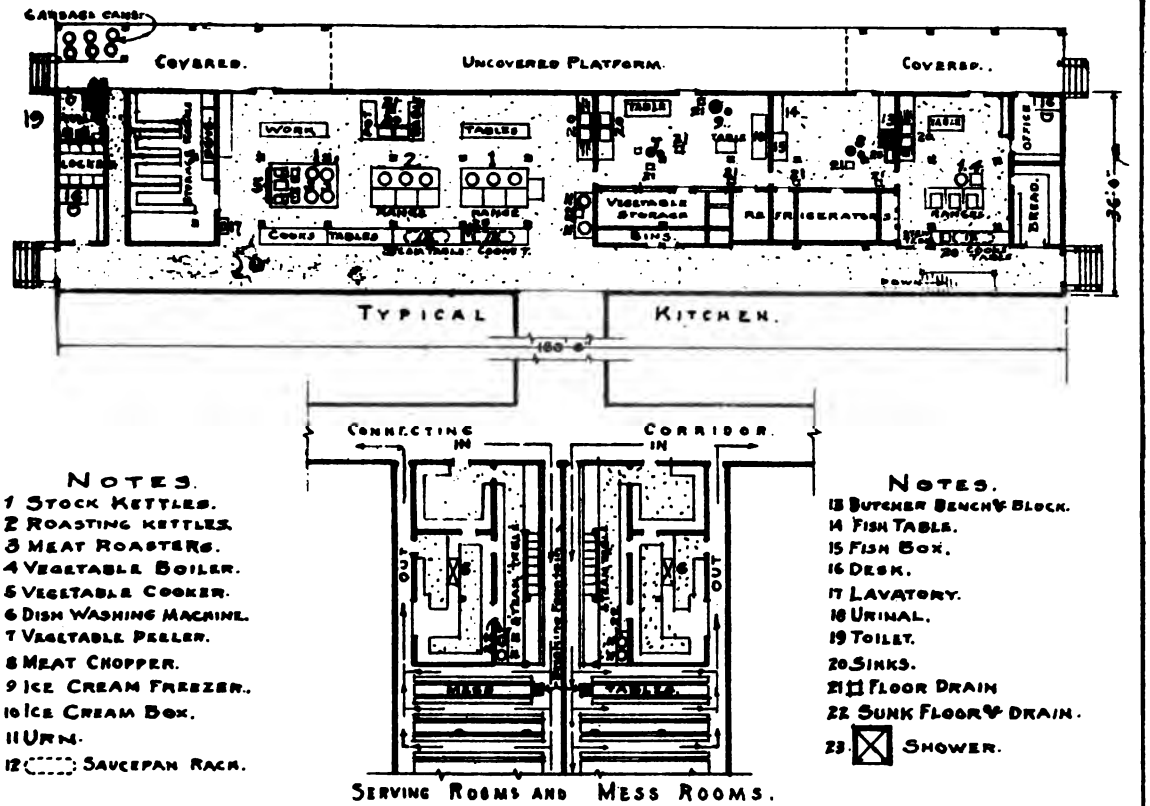






TYPICAL DISH WASHING PANTRIES
FOR HOSPITAL AND MESS KITCHENS

CONSTRUCTION DIVISION OF THE ARMY
HOSPITAL BUILDINGS
TYPICAL KITCHEN LAYOUT



NOTES.

1 STOCK KETTLES.
2 ROASTING KETTLES.
3 MEAT ROASTERS.
4 VEGETABLE BOILER.
5 VEGETABLE COOKER.
6 DISH WASHING MACHINE.
7 VEGETABLE PEELER.
8 MEAT CHOPPER.
9 ICE CREAM FREEZER.
10 ICE CREAM BOX.
11 URN.
12 SAUCEPAN RACK.

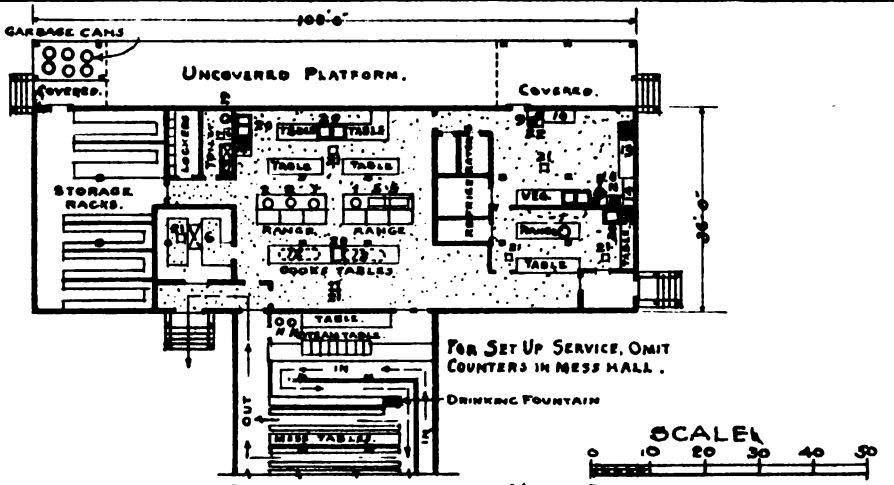
NOTES.

13 BUTCHER BENCH & BLOCK.
14 FISH TABLE.
15 FISH BOX.
16 DESK.
17 LAVATORY.
18 URINAL.
19 TOILET.
20 SINKS.
21 FLOOR DRAIN
22 SUNK FLOOR DRAIN.
23 SHOWER.

SERVING ROOMS AND MESS ROOMS.
TYPICAL · LAYOUT.
FOR
HOSPITAL · MESS AND KITCHEN, 3000 TO 5000 CAPACITY.

SCALE
0 10 20 30 40 50

FOR ORIGINAL PLAN, SEE DRAWING 6402-938


100'-0"
GARBAGE CANS
COVERED.
UNCOVERED PLATFORM.
COVERED.
STORAGE RACKS.
TABLE
TABLES
RANGES
RANGE
COOKS TABLES
VEG.
REFRIGERATOR
SINK
TABLE
TABLE
TABLE

serving counter for direct return of dishes, etc., for use again. See typical layouts, Plate No's 137 and 138.

(c) *Ward Service:* Each kitchen which serves to wards, has a Special Diet Kitchen in connection with the main kitchen, in which all special diets required for wards are prepared. Service from main and special Diet Kitchen is conveyed to wards by special conveyor carts.

Each ward throughout the hospital, is equipped with a Ward Diet Kitchen from which food is served to the patient. Each Ward Diet Kitchen is equipped with one 8 inch electric hot plate and two 10 inch electric grilles for warming and for light cooking. Utensils used with equipment in these kitchens, are furnished through the office of the Surgeon General.

Note: Where Officers' or Nurses' Mess and Kitchen occur in hospitals, they should have similar and proportionate equipment to general mess and kitchen, with a slight difference in arrangement.

CAFETERIA CLASSIFICATION:

Cafeterias are classified as follows:

(1) *The Hospital Cafeteria,* which is arranged and equipped to serve a limited bill of fare from bulk quantities, during a period of about one hour and a quarter.

(2) *The Housing or Industrial Plant Cafeteria,* which is arranged and equipped to serve a more varied bill of fare over a longer period of time.

COUNTER SERVICE:

(a) The service counter for both classes of cafeterias should be approximately 35 feet long, for a seating capacity of 250 to 350. With a seating capacity of 350, one thousand men can be fed in about one hour and a quarter.

(b) The counter equipment for Hospital Service consists of a battery of urns, figured at the rate of ten cups to a gallon and a steam table containing up to 8 large size containers as shown on Plate No. 136.

(c) The counter equipment for Housing or Industrial Plant Cafeterias, consists of a battery of two ten gallon coffee urns with one fifteen gallon water urn, a steam table arranged with two meat platters and ten three gallon china containers to provide for a more varied bill of fare.

EQUIPMENT:

Kitchen equipment needed for kitchens and cafeterias of various sizes, is given on Plate No's 134 and 135. It should be of sanitary design, neat in appearance and should be constructed in accordance with approved standard equipment.

BAKERIES.

A central or post bakery of sufficient capacity should be provided for each cantonment. The rated capacity as given in the following schedule is based on operating twenty-four hours a day.

BAKERY EQUIPMENT:

Fixtures	*1 Oven*	*2 Oven*	*3 Oven*	*4 Oven*
Bake Oven, 120 sq. ft.	1	2	3	4
Bread Racks	12	25	40	50
Dough Troughs	7	15	24	30
2 Barrel Dough Mixer	1	..	..	..
3 Barrel Dough Mixer	..	1	1	1
Refrigerator 4 ft. 6 in. x 2 ft. 6 in. x 7 ft. 6 in.	1	..	..	..
Refrigerator 5 ft. x 3 ft. 6 in. x 7 ft. 10 in.	..	1	1	1
Capacity, Men	1,000 to 10,000	10,000 to 20,000	25,000 to 35,000	35,000 to 50,000

HEATING.

GENERAL:

It is the general policy of the Construction Division to provide stoves or room heaters, for heating all buildings where such equipment can be used with a reasonable degree of safety, comfort and convenience, for their occupants, or where suitable to the purposes for which the building is to be used. Such buildings include principally barracks and cantonment buildings in general.

Buildings which do not come under the above classification are steam heated, either by means of individual or central plants. Such buildings include hospitals, where safety and comfort of the occupants are of first importance; warehouses, repair shops, fire stations, laundries, etc., where stoves are unsuitable; and officers' quarters, medical infirmaries, dental infirmaries, etc., where the large number of small rooms makes stove heating impracticable.

Note: The general information contained under this heading or on the Plates pertaining to this subject, are not to be considered as adequate specifications for materials to be furnished or for work to be done. Standard heating plans have been prepared for hospital buildings, warehouses, cantonment buildings, laundries, reclamation units, etc., etc., and are available upon application to the Washington office. Before actual work is begun on any project, or standard building, consideration must be given to existing conditions and necessary modifications should be made in general conformity with the established design.

COMPUTATION OF HEAT LOSS:

The heat loss from buildings is computed in the same manner whether buildings are to be steam-heated or stove-heated.

Computations for the usual cantonment type of construction, consisting of studding with boards and building paper on the outside and wall-board on the inside, are based on the following co-efficients, expressed in B. T. U. per hour per degree difference in temperature between inside and outside:

(1) Net exposed wall surface per sq. ft..... .25
(2) Glass surface per sq. ft.....1.0
(3) Crack around outside windows and doors per lin. ft.....1.8
(4) Cold floors per sq. ft..... .3
(5) Cold ceiling per sq. ft..... .25

(Allowance for loss by leakage is computed as indicated under item No. 3, instead of basing it on the cubic contents of the heated room.)

Special attention is paid to the inside temperature requirements for buildings of various types and such requirements are classified in so far as is practicable. Thus, hospital wards and bath rooms are heated to 70 degrees, operating and recovery rooms for hospitals are heated to 80 degrees. Barracks and officers' quarters are heated to 60 degrees and warehouses are, in general, heated to 45 degrees.

The heating plants for various types of buildings are standardized in so far as possible and heating equipment is designed with reference to three temperature zones, which are indicated on a map of the United States, see Plate No. 139. These zones are based on minimum temperatures as follows:

"A or Z" Plus 20 degrees, F.
"B or Y" Zero, F.
"C or X" Minus 20 degrees, F.

Standard heating plans used throughout the United States, are figured with reference to location in either of the zones above mentioned.

Note: An exception should be made to the temperature zones as indicated on the above mentioned map insofar as coast defense posts on the Pacific Coast are concerned, including those in the vicinity of San Francisco and south of San Francisco. Heating computations in these localities should be based on a minimum outside temperature of plus 40 degrees Fahrenheit.

STEAM HEATING.

CLASSIFICATION:

In general, hospitals are heated from central plants, in order to keep noise and dirt away from the buildings and to provide for convenient operation.

In the case of certain types of construction, such as buildings at ordnance proving grounds, gas plants, etc., where it is extremely important to minimize fire risk, central plants are installed even though the first cost may be materially increased thereby.

Other steam-heated buildings are usually provided with separate plants, due to the fact that such buildings are usually more or less isolated and to the necessity for keeping the cost of installation at a minimum. Unless buildings are closely grouped, the installation of individual plants is usually more economical of time, labor and material than is the installation of a large central heating plant.

Warehouses and other buildings at interior storage depots and port terminals, and manufacturing plants in general, are usually heated from central plants.

CENTRAL PLANTS:

Boiler Plants are standardized in so far as possible, the units generally installed being 150 HP boilers of the horizontal return tubular type. These boilers are of the commercial type most readily obtainable in any market throughout the country. The 150 HP unit has been found to be the most economical size from the manufacturer's viewpoint, and is usually adaptable to conditions met with in the work of the Construction Division.

Standard types and sizes of boiler plant equipment, such as feed water heaters, boiler feed pumps, vacuum pumps, receiving tanks, etc., have been used in so far as possible and typical methods of connecting such equipment are shown on Plate No's 140, 141, 142, 143, 144 A, 144 B, 145 C, 145 D, 146 A, 146 B, 146 C, 146 D.

Feed water heaters of the open type are generally used, due to their value in removing temporary hardness from feed water.

Boiler feed pumps of the 6-inch by 4-inch by 6-inch size, have been generally used as standard with a normal rating of 400 boiler horse power, with steam at 100 lbs. working pressure.

Due to the difficulty in obtaining steel plate, boiler plants of 600 HP and over have generally been provided with radial brick smoke stacks. Under normal conditions this practice would be modified to some extent.

Main Distributing Piping in connection with central heating plants is for the most part, run on poles or in buildings, rather than underground, thus effecting a minimum of cost and time for installation. Plate No's 145 A, 145 B. Where interconnecting corridors occur, the mains run either at the ceiling or below the floor of corridors as conditions indicate.

Special attention should be given to the matter of expansion in connection with distributing piping, particularly where high or medium pressure steam is used; and packed expansion joints, anchors and swing joints are employed to provide for this condition.

High pressure steam piping is usually designed on the basis of one pound drop in 100 feet, in order to insure adequate capacity for possible future extensions. Thus it is possible to increase the carrying capacity of steam mains in some instances as much as 100 per cent.

For hospital work, the distributing system of piping usually consists of high or medium pressure mains, condensation returns from heating system and steam line drip piping.

Return mains for central heating systems are often omitted in connection with temporary or semi-permanent construction, unless buildings are closely grouped. Where boiler feed water contains a large amount of hardness, return systems are, however, generally installed.

Where runs of return piping are comparatively short and where sufficient grade can be obtained to provide for gravity return of condensation, vacuum pumps are not generally used, but returns are brought back to an open receiver in the boiler house by gravity. Where such conditions do not exist, vacuum pumps should be used to accelerate the return of condensation.

Insulation for steam distributing piping is obtained by means of built-up covering consisting of 1-inch asbestos air-cell covering and 1-inch of hair felt or other suitable slow-burning material. The hair felt is covered with two-ply roofing paper, and the whole bound together with wire and painted with asphaltum paint. At joints the paper is to be soaked with pitch and lapped at least 2 inches. It has been found that the saving of labor in the field, justifies the manufacture of this covering as described, in built up units 3 ft. long. Where underground mains are installed in connection with temporary construction, same are generally enclosed in boxing constructed of 2-inch creosoted planks.

All steam and return piping, valves and fittings in buildings, except in heated rooms, are covered with 1-inch air cell sectional covering with canvas jacket and metal bands.

Heating Systems in Buildings: At points where steam pipe enters building, pressure is brought down to about 2 pounds by means of a pressure reducing valve, and steam is distributed to radiating surfaces throughout the building, through a system of main and return distributing piping.

In connection with temporary or semi-permanent construction, steam main is usually run at the ceiling of first story, with one-pipe connections to second story radiators (if any) taken out of the top of main. Second story radiators are provided with angle valves. Connections to first story radiators are taken out of the bottom of main, each connection being provided with a drip to the return main below floor. One-pipe connections to first story radiators are taken out of drop riser above floor, each connection being provided with a gate valve. See Plate No. 144 D.

Return piping below floor is collected at one or more points and arranged to discharge through steam traps of the float or thermostatic type, to main return piping leading to boiler house.

Where no main return system is installed, the heating drips from each building are collected in a system of return pipes run beneath floor and discharged to dry well or to sewer through a suitable cooling sump as may be required.

Where conditions warrant, in the case of permanent construction or elsewhere, a standard system of vacuum returns is installed, and the return end of each radiator is equipped with a thermostatic trap. See Plate No. 144 C.

AUTOMATIC TEMPERATURE CONTROL:

In general, the use of automatic temperature controlling apparatus is not favorably considered in connection with work of a temporary character.

Temperature controlling apparatus should, however, be installed in heated warehouses where a minimum inside temperature of 45 degrees or 50 degrees F. is satisfactory, as the automatic maintenance of this low temperature will inevitably result in a large saving in fuel.

In connection with certain industrial and chemical processes, ammunition storage, etc., automatic temperature regulation is essential.

In connection with permanent work of any magnitude, particularly in the case of hospital work, consideration should be given to the installation of automatic temperature controlling apparatus.

INDIRECT HEATING AND VENTILATION:

Where buildings containing rooms with large volumes of air are to be heated, such as mechanical repair shops, auditoriums, garages or class rooms, a blast system of heating, with motor or engine driven fan and heating coils, should be used. The so-called unit heater with a motor driven blower and coil in a single housing, may be used in large rooms where the air can be recirculated.

Systems of mechanical ventilation, with fans and distributing ducts are installed for office and administrative portions of large warehouses, where crowded floor space and insufficient opening to outside air make it necessary.

The requirements for ventilation in chemical plants for laboratory work, the special limitations and conditions imposed by work in loading and testing areas of proving grounds, all require study of each project, the results of which cannot be described in detail.

INDIVIDUAL PLANTS:

Isolated buildings, such as officers' quarters, medical infirmaries, dental infirmaries, and repair shops for motor transport, fire stations, telephone exchanges, etc., are usually provided with individual steam heating plants employing cast iron boilers. Individual systems are of the gravity return type, with steam main at first story ceiling dripped at each first floor radiator connection, or with one pipe circuit main below first floor, as may be best suited to existing conditions. See Plate 144 D, for one pipe gravity system.

Boiler Houses: When individual heating plants are provided with separate boiler houses, they are located at the lowest points available, adjacent to building or buildings to be heated. Boiler houses are constructed of wood with concrete floors and concrete walls up to a point about 4 feet above boiler house floor level. Where possible, boilers are located in cellars beneath buildings to be heated.

Floor level of the boiler house or of cellar in which boiler is located, must be such as to bring the water line of boiler at least 20 inches below the bottom of the lowest radiator, or in the case of the one pipe system, below the bottom of steam supply main where lowest branch connection to radiator is taken off.

Drainage from boiler room floor is connected to sewer where possible. Where such connection cannot be made, a sump is constructed and bilge pump is provided.

Piping Notes: Any steam or return piping between boiler house and buildings to be heated, is covered in the same manner as described in connection with central heating plants.

Steam piping is usually suspended on poles, where boiler house is at any considerable distance from building to be heated. See Plate No's 145 A, 145 B. The return pipes are placed above the water line of boilers where possible to keep the runs "dry" and to prevent freezing when plant is shut down.

PIPE SCHEDULES (STEAM).

One Pipe Mains, without drips, up to 200 feet runs.

Inches	Rad'n sq. ft.	Inches	Rad'n sq. ft.
1	0-40	3	451-850
1¼	41-85	3½	851-1250
1½	86-135	4	1251-1800
2	136-275	5	1801-3400
2½	276-450	6	3401-5600

Two Pipe Steam, dripped at every radiator branch, and return size.

Steam Inches	Return Inches	Rad'n sq. ft.	Steam Inches	Return Inches	Rad'n sq. ft.
1	1	0-65	3	2	666-1192
1¼	1	66-136	3½	2	1193-1740
1½	1	137-212	4	2½	1741-2380
2	1¼	213-384	5	2½	2381-4180
2½	2½	385-665	6	3	4181-6750

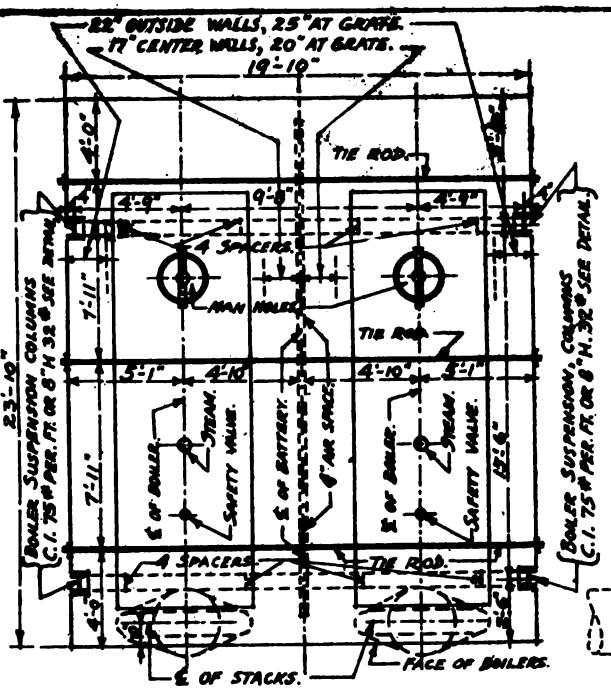
EXPLANATION

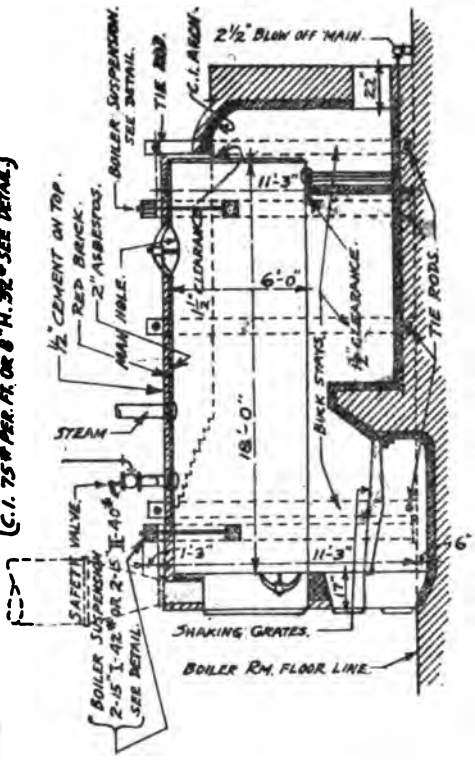
All Typical Buildings with the exception of the Officers Quarters, Medical Buildings and like Buildings are Stove Heated, unless directed otherwise. Stoves are shown on the Plans in the location where they should be installed and are indicated for Three Different Zones namely X.Y.& Z. These Zones are given on the Map above. All Heating Material released is in accordance with this map and it is therefore important that the Constructing or Camp Quartermasters locate their camps accurately.

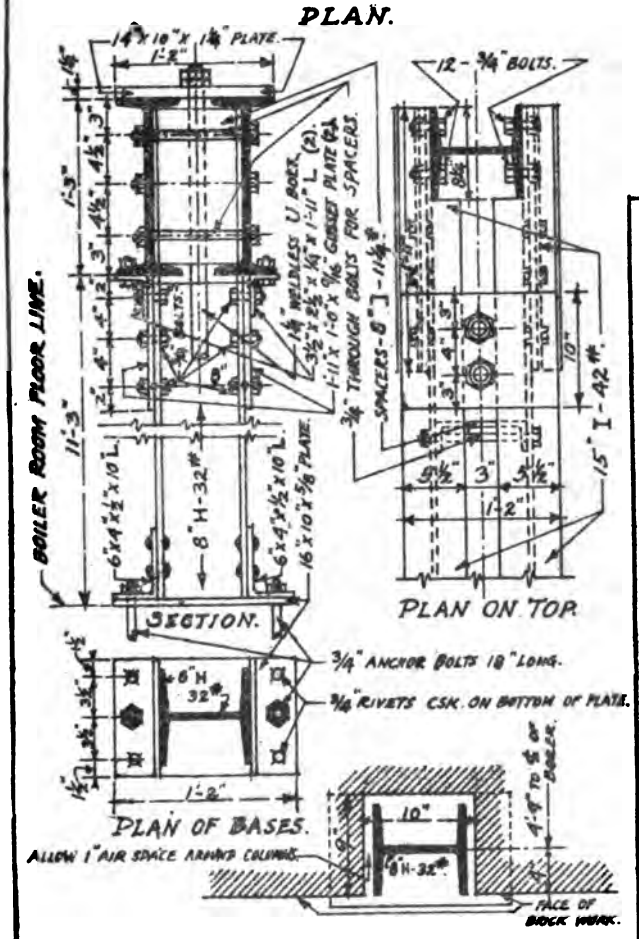
NOTE.

All National Army and National Guard Camps, Camp Knox, Camp Bragg and other Army Posts necessary to give the Zone Boundries are given.

CONSTRUCTION DIVISION OF THE ARMY
TEMPERATURE MAP
STEAM HEATING ZONES-A-B-C-STOVE HEATING ZONES-X-Y-Z-






14" X 18" X 1¼" PLATE.
12 - ¾" BOLTS.
¼" WELDLESS U BOLT. 3½" X 2½" X ¼" X 1'-11" L (2).
1'-11" X 1'-0" X ⅝" GUSSET PLATE (2).
¾" THROUGH BOLTS FOR SPACERS.
SPACERS - 8" [- 11½#.
15" I - 42#.
BOILER ROOM FLOOR LINE.
8" H - 32#
SECTION.
PLAN ON TOP.
¾" ANCHOR BOLTS 18" LONG.
¾" RIVETS CSK. ON BOTTOM OF PLATE.
PLAN OF BASES.
ALLOW 1" AIR SPACE AROUND COLUMNS.
FACE OF BRICK WORK.

APPROXIMATE WEIGHTS FOR ONE (1) BATTERY OF TWO (2) 150 H.P. BOILERS SET UP COMPLETE.

SUSPENDED WEIGHTS,-

BOILERS, TUBES, WATER, ETC.	= 84000	
2-36" STACKS AND GUY WIRES	= 10000	ALTERNATES
1-48" STACK, GUY WIRES AND BREECHING	= 10200	

FOUNDATION LOADS-

ADD THE ABOVE WEIGHTS TO THE FOLLOWING TO OBTAIN THE TOTAL LOAD:-

BRICK, FULL FRONTS, TRIMMINGS, ETC.	= 284000	
4-C. I. COLUMNS @ 75# PER. FT.	= 3400	ALTERNATES
4-8" H COLUMNS @ 32#	= 1600	
4-15" I BEAMS @ 42#	= 3400	ALTERNATES
4-15" [@ 40#	= 3200	

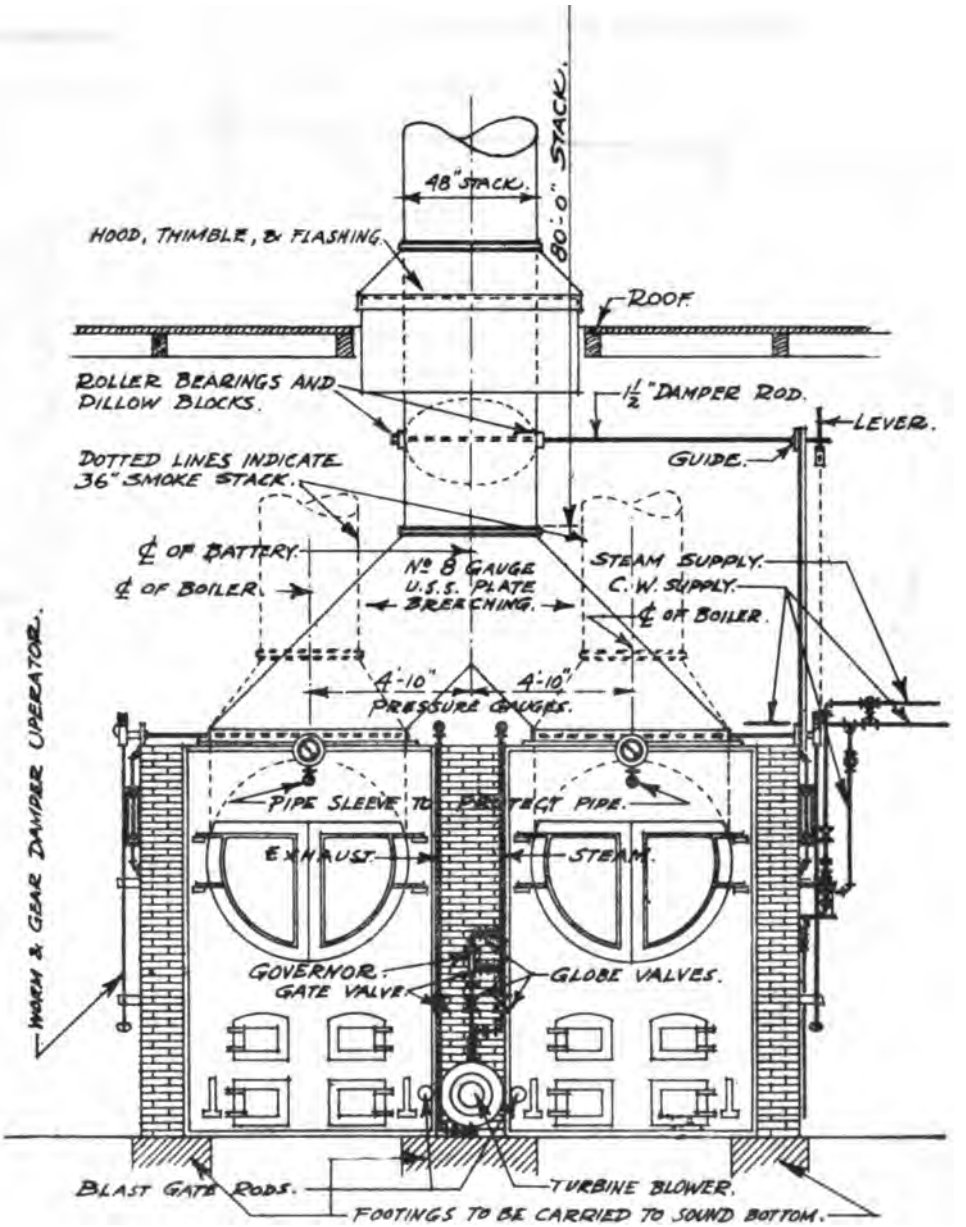
CONCRETE MIX:
1 - 2 - 4.

MORTAR MIX: 16 SAND, 4 UNSLACKED LIME, 1 CEMENT.

FIRE BRICK: DIPPED IN FIRE CLAY MORTAR.

CONSTRUCTION DIVISION OF THE ARMY

SETTING DETAILS FOR ONE BATTERY 150 H.P. BOILERS 6'0" X 18'0"



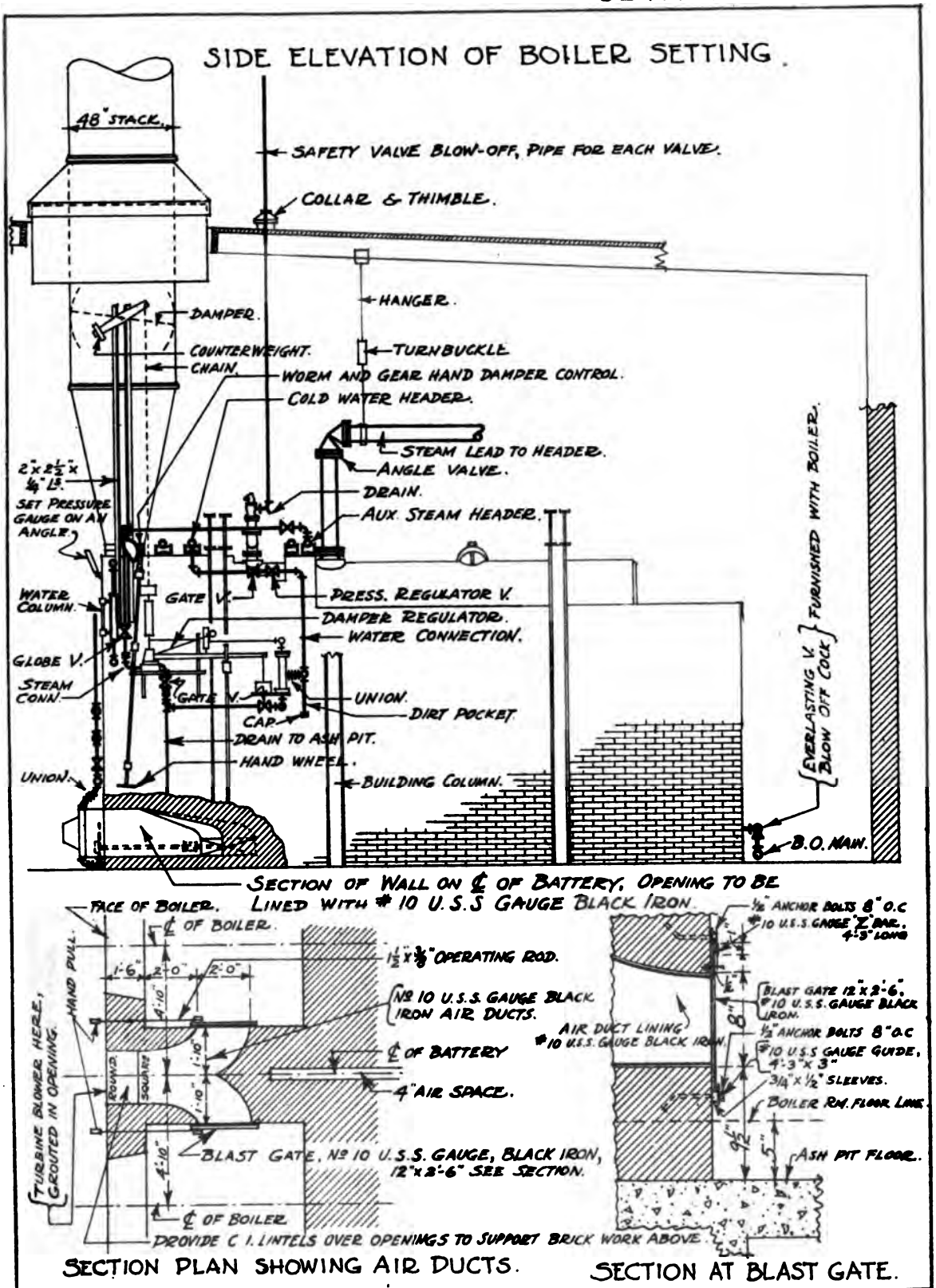
FRONT ELEVATION OF BATTERY SETTING.

FOR DETAILS OF SETTING SEE D'WG. 412.2-18.

CONSTRUCTION DIVISION OF THE ARMY

TYPICAL DETAILS

BOILER HOUSE PIPING & EQUIPMENT SHEET A



CONSTRUCTION DIVISION OF THE ARMY

TYPICAL DETAILS

BOILER HOUSE PIPING & EQUIPMENT SHEET B

CONSTRUCTION DIVISION OF THE ARMY

PIPING SPECIFICATIONS · BOILER HOUSE

THIS DOES NOT APPLY TO DISTRIBUTING LINES

SERVICE	PIPE	FITTINGS	VALVES	GASKETS	FLANGES	COVERING
MAIN STEAM NOT EXCEEDING 125# PRESSURE SAT STEAM	2" AND UNDER F.W. WRT. IRON OR STEEL 2½"-12" F.W. WROUGHT IRON OR STEEL 14" AND OVER O.D STEEL ⅜" THICK	5" AND UNDER STD SCR C I 6"-12" STD. FLGD. C I 14" AND OVER STD FLGD C.I.	1½" AND UNDER STD. SCR. ALL BRONZE 2"-5" STD. SCR. IRON BODY & BRONZE 6" AND OVER STD. FLGD IRON BODY & BRONZE (O. S. & Y PATTERN)	COMPRESSED ASBESTOS 1/16" THICK	2½" TO 3½" STD. C.I. COMPANION 4 AND OVER STD C I VAN STONE, PATTERSON ALLEN, OR COMPANION	STANDARD THICK 85% MAGNESIA
AUX. STEAM & HIGH PRESSURE DRIPS NOT EXCEEDING 125# PRES.	2" AND UNDER F.W WRT IRON OR STEEL 2½"-12" E W WROUGHT IRON OR STEEL 14" AND OVER O.D. STEEL ⅜" THICK	2" AND UNDER STD SCR. C.I. 2½" AND OVER STD. FLGD C.I.	2" AND UNDER STD SCR. ALL BRONZE 2½"-5" STD. FLGD. IRON BODY & BRONZE 6" AND OVER STD. FLGD. IRON BODY & BRONZE (O.S & Y. PATTERN)	COMPRESSED ASBESTOS 1/16" THICK	2½" AND OVER STD C I COMPANION	STANDARD THICK 85% MAGNESIA
FEED DISCHARGE NOT EXCEEDING 125# PRES.	2" AND OVER E.H. WRT. IRON OR STEEL 2½" AND OVER E.H. WRT. IRON OR STEEL OR UNIVERSAL C.I. STD. FOR 125#	2" AND UNDER STD. SCR. C.I. 2½" AND OVER STD. FLGD. C.I.	2" AND UNDER STD. SCR. ALL BRONZE 2½"-5" STD. FLGD. IRON BODY & BRONZE 6" AND OVER STD. FLGD. IRON BODY & BRONZE (O.S. & Y. PATTERN)	COMPRESSED ASBESTOS 1/16" THICK	2½" AND OVER STD C I COMPANION	STANDARD THICK 85% MAGNESIA
BOILER BLOW-OFF NOT EXCEEDING 125# PRES.	2" AND UNDER E. H. WRT. IRON OR STEEL 2½" AND OVER E H. WRT. IRON OR STEEL	2" AND UNDER STD. SCR. C.I. 2½" AND OVER STD. FLGD. C.I.	2" AND UNDER STD. SCR. ALL BRONZE 2½"-5" STD. FLGD. IRON BODY & BRONZE 6" AND OVER STD. FLGD. IRON BODY & BRONZE (O.S. & Y. PATTERN)	COMPRESSED ASBESTOS 1/16" THICK	2½" AND OVER STD C I. COMPANION	NONE
FEED SUCTION-LOW PRES. SERVICE & CITY WATER. MISC WATER VACUUM PUMP	2" AND UNDER F.W. GALV. IRON OR STEEL 2½" AND OVER STD. GALV. IRON OR STEEL	2" AND UNDER STD. SCR. C.I. 2½" AND OVER STD. FLGD. C.I.	2" AND UNDER STD. SCR. COMPOSITION (INSIDE SCREW PATTERN) 2½"-5" STD. FLGD. C.I. & BRONZE. 6" AND OVER STD. FLGD. C.I. & BRONZE (O.S. & Y. PAT'N)	RAINBOW 1/16" THICK	2½" AND OVER STD C.I. COMPANION	NONE
EXHAUST & L.P. DRIPS	2" AND UNDER F.W. WRT. IRON OR STEEL 2½" AND OVER STD. WRT IRON OR STEEL	4" AND UNDER STD. SCR. C.I. 5" AND OVER STD. FLGD. C.I.	2" AND UNDER STD. SCR. COMPOSITION (INSIDE SCREW PATTERN) 2½"-4" STD. SCR. C.I. & BRONZE, 5" AND OVER STD. SCR C.I. & BRONZE (O.S. & Y. PATT'N)	RAINBOW 1/16" THICK	5" AND OVER STD. C I COMPANION	EXHAUST AIR CELL SECTIONAL MOULDED 1" THICK NO COVERING REQUIRED ABOVE BACK PRESSURE VALVE OF F W HEATR OF FOR L P DRIPS

NOTES:

BY COMPRESSED ASBESTOS GASKETS IS MEANT EITHER DURABLA, GARLOCK 950, PERMANITE, KLINGERAT RIVERLATE, TAURIL, ETC

ALL UNIONS BELOW 3½" IN DIAMETER SHALL BE OF GROUND JOINT TYPE AND MADE OF BRASS.

ALL UNIONS 4" AND OVER SHALL BE FLANGED STANDARD WEIGHT CAST IRON.

UNLESS UNAVOIDABLE 3½", 4½", 7" & 9" PIPE SHALL NOT BE USED.

DIMENSIONS AND DRILLING OF ALL FITTINGS AND FLANGES TO BE AMERICAN ST'D.

WHERE FLANGES ARE SCREWED ON PIPE THEY SHOULD BE MADE ON AS TIGHT AS IT IS SAFE AND THE PIPE SHALL BE MADE ENTIRELY THROUGH THE FLANGE UNTIL IT IS FLUSH WITH THE FACE.

JOINTS MADE WITH SCREW END FITTINGS SHALL HAVE PIPE THREADS THOROUGHLY SLUSHED WITH GRAPHITE OR CEMENT OF APPROVED MAKE AND MADE INTO THE FITTINGS AS TIGHT AS IT IS SAFE TO SCREW THEM.

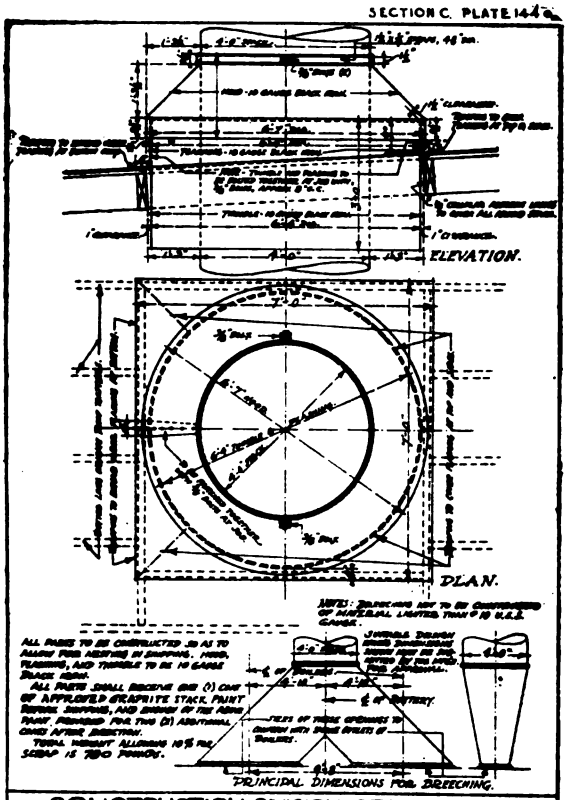
ALL BOLTS SHALL BE MADE OF BOLT STEEL AND SHALL HAVE CLEAN CUT U.S. THREADS WITH UPSET SQUARE HEADS & SEMI-FINISHED HEXAGONAL COLD PRESSED NUTS

HANGERS AND SUPPORTS SHALL BE LOCATED APPROXIMATELY 12" O C. ALL HANGERS AND SUPPORTS SHALL BE INSTALLED SO THAT THEY WILL NOT INTERFERE IN ANYWAY WITH THE EXPANSION AND CONTRACTION OF THE PIPING.

AFTER PIPING SYSTEM HAS BEEN ERECTED IT SHALL BE BLOWN CLEAN OF DIRT AND CHIPS BEFORE CONNECTIONS ARE MADE TO ANY APPARATUS

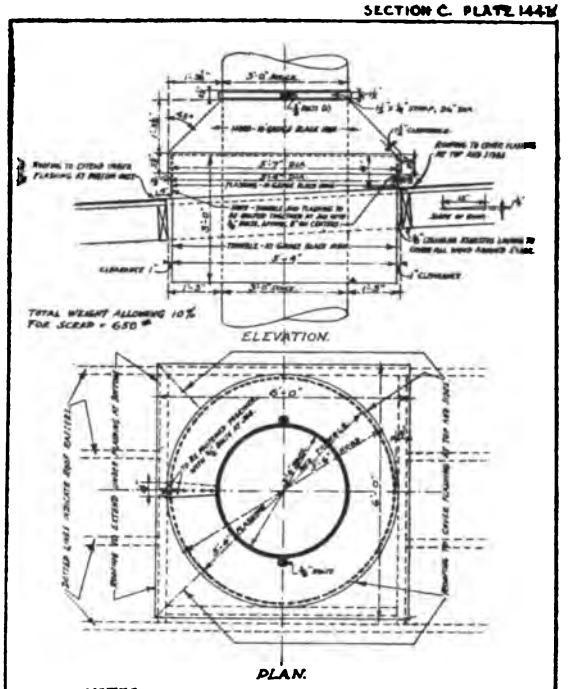
F.W = FULL WEIGHT
E. H. = EXTRA HEAVY
C I. = CAST IRON
O D. = OUTSIDE DIAMETER
O.S.Y. = OUTSIDE SCREW & YOKE
SCR. = SCREW
FLGD. = FLANGED
ST'D. = STANDARD.

SECTION C. PLATE 144



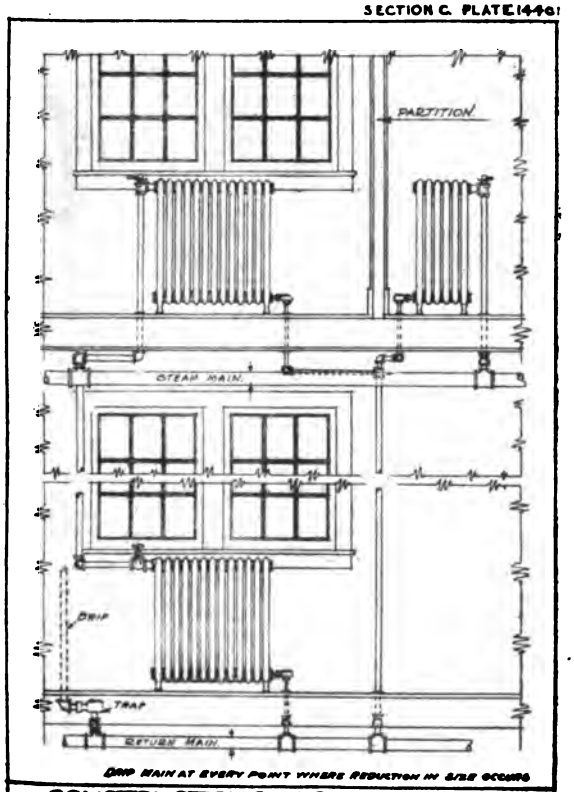
CONSTRUCTION DIVISION OF THE ARMY
TYPICAL DETAILS
HOOD FLASHING & THIMBLE FOR 48" SMOKE STACKS

SECTION C. PLATE 144A


ELEVATION.
PLAN.
NOTES:
ALL PARTS TO BE CONSTRUCTED SO AS TO ALLOW FOR NESTING IN SHIPPING. HOOD, FLASHING, AND THIMBLE TO BE 10 GAUGE BLACK IRON. ALL PARTS SHALL RECEIVE ONE (1) GOOD COAT OF APPROVED GRAPHITE STACK PAINT BEFORE SHIPPING, AND BRUSH OF THE ABOVE PAINT PROVIDED FOR TWO (2) ADDITIONAL COATS AFTER ERECTION.

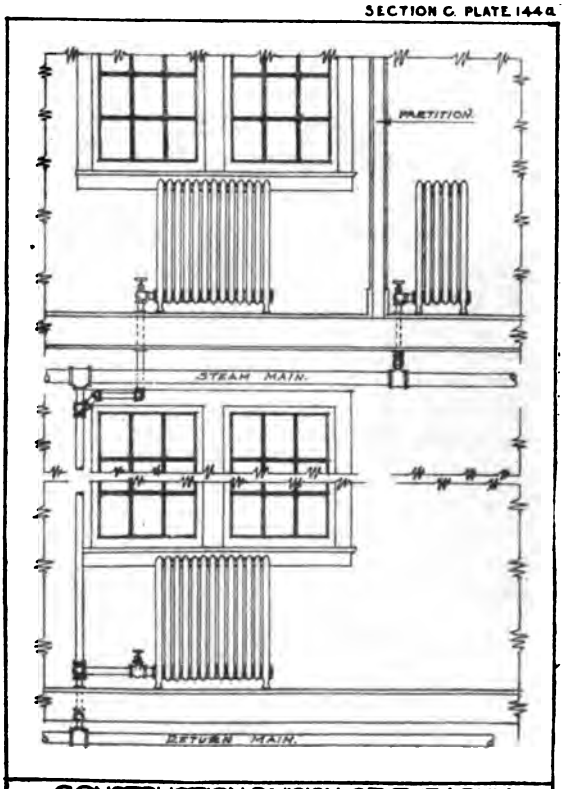
CONSTRUCTION DIVISION OF THE ARMY
TYPICAL DETAILS
HOOD & FLASHING FOR 36" SMOKE STACKS

SECTION C. PLATE 144B



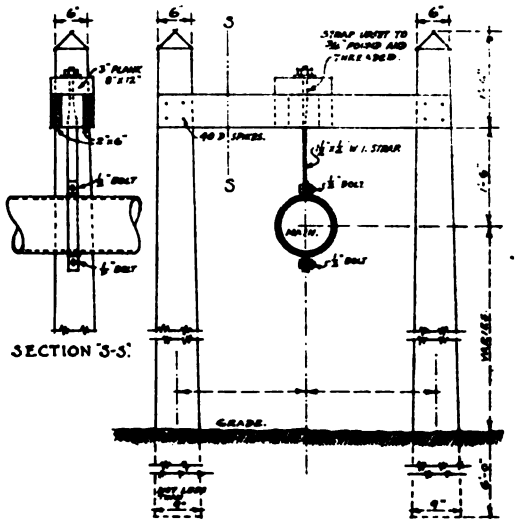
CONSTRUCTION DIVISION OF THE ARMY
TYPICAL DETAILS
TWO PIPE VACUUM HEATING SYSTEM

SECTION C. PLATE 144C



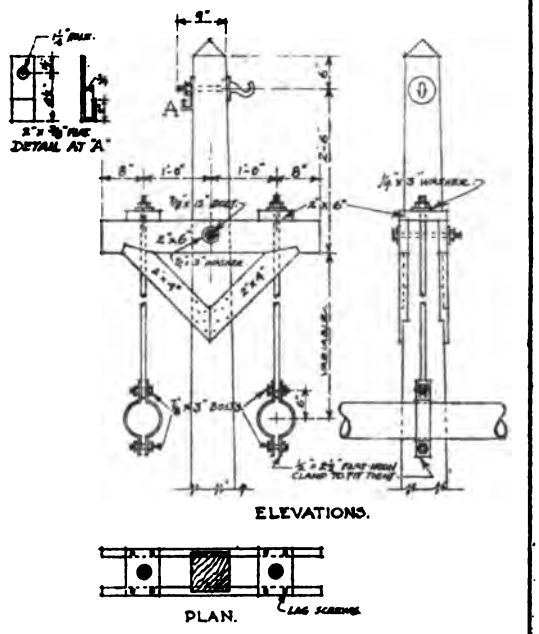
CONSTRUCTION DIVISION OF THE ARMY
TYPICAL DETAIL FOR ONE PIPE
GRAVITY STEAM HEATING SYSTEM

SECTION C. PLATE 145a



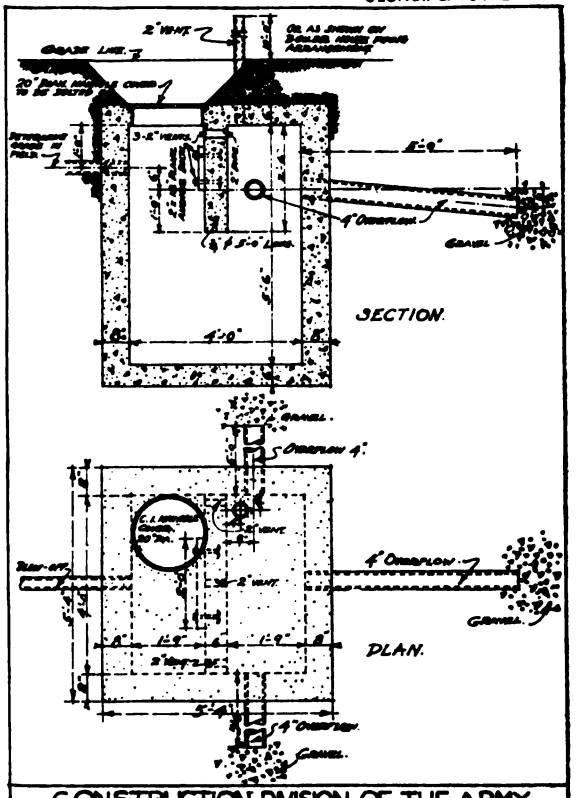
CONSTRUCTION DIVISION OF THE ARMY
TYPICAL DETAILS
OVERHEAD STEAM MAIN SUPPORT

SECTION C. PLATE 145 b



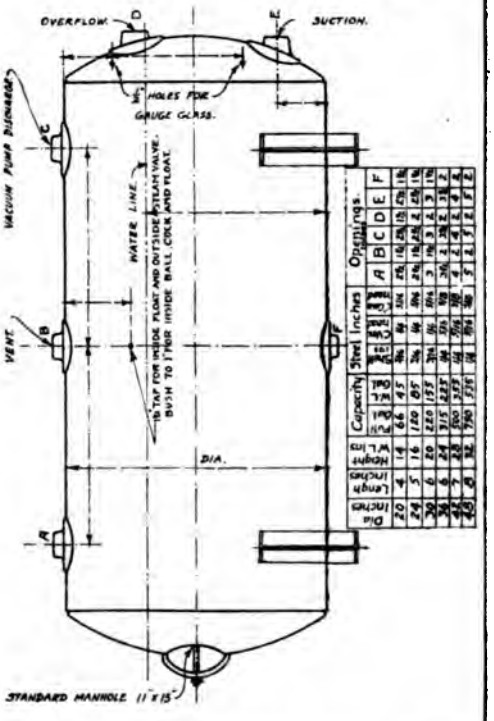
CONSTRUCTION DIVISION OF THE ARMY
STANDARD DETAIL
POLE HANGER

SECTION C. PLATE 145 c



CONSTRUCTION DIVISION OF THE ARMY
TYPICAL DETAILS
CONCRETE BLOW-OFF TANK

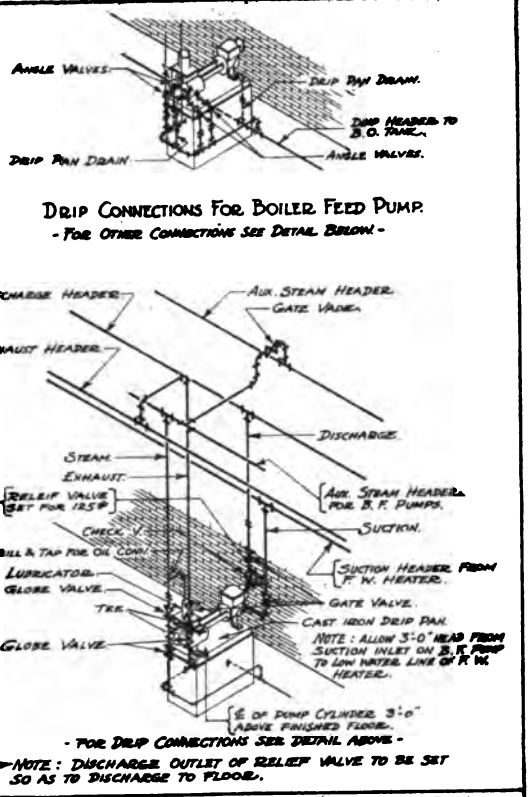
SECTION C. PLATE 145d.



Dia. Inches	Length Inches	Height C.L. to Top	Capacity Gal.	Steel Inches	Openings A	B	C	D	E	F
24	4	4	44	4'5	8½	8½	15	15	15	15
30	5	5	110	6'5	9½	9½	15½	15½	15	15
36	6	6	220	7'5	10½	10½	16½	16½	15	15
42	7	7	315	8'5	11½	11½	17½	17½	15	15
48	8	8	500	9'5	12½	12½	18½	18½	15	15
60	10	10	780	11'5	14½	14½	20½	20½	15	15

CONSTRUCTION DIVISION OF THE ARMY
RECEIVING TANK

SECTION C. PLATE 146a



DRIP CONNECTIONS FOR BOILER FEED PUMP.

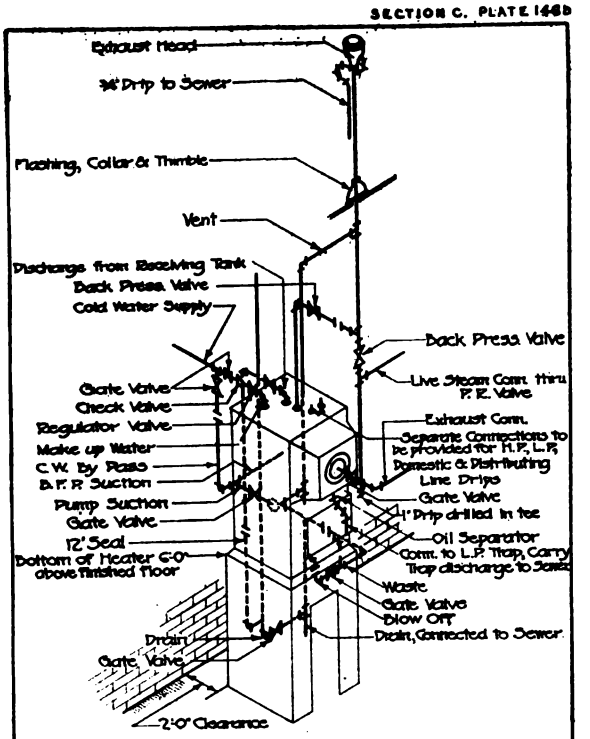
- FOR OTHER CONNECTIONS SEE DETAIL BELOW -

- FOR DRIP CONNECTIONS SEE DETAIL ABOVE -

NOTE: DISCHARGE OUTLET OF RELIEF VALVE TO BE SET SO AS TO DISCHARGE TO FLOOR.

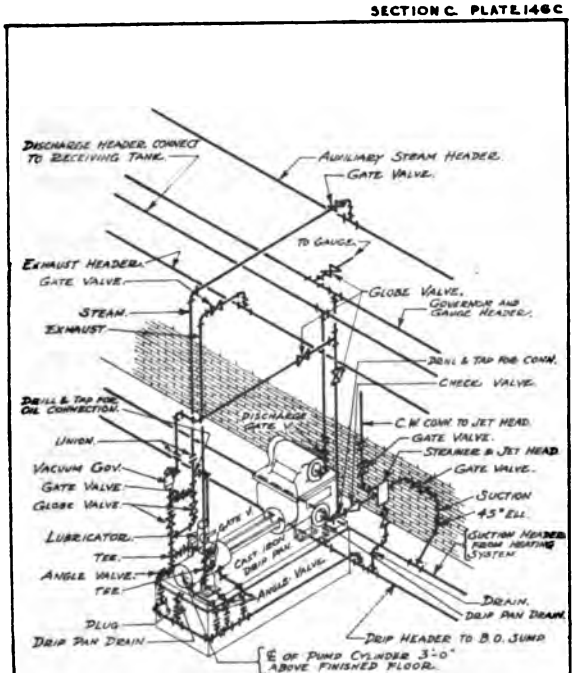
CONSTRUCTION DIVISION OF THE ARMY
TYPICAL DETAILS
CONNECTIONS FOR A BOILER FEED PUMP

SECTION C. PLATE 146b



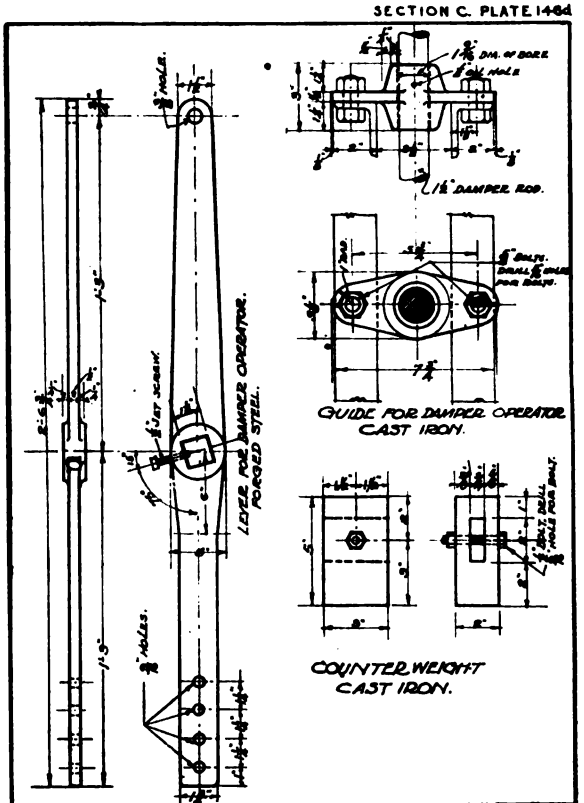
CONSTRUCTION DIVISION OF THE ARMY
FEEDWATER HEATER
DETAILS OF PIPE CONNECTIONS

SECTION C. PLATE 146c



CONSTRUCTION DIVISION OF THE ARMY
TYPICAL DETAILS
CONNECTIONS FOR A VACUUM PUMP

SECTION C. PLATE 146d



CONSTRUCTION DIVISION OF THE ARMY
TYPICAL DETAILS
DAMPER OPERATOR GUIDE & LEVER

Pressure Reducing Valves.

Radiation sq. ft.	Inches
213-384	1¼ x 2
385-665	1¼ x 2½
666-1192	1½ x 3
1193-1740	2 x 3½
1741-2380	2 x 4
2381-4180	2½ x 5
4181-6750	3 x 6

STOVE AND FURNACE HEATING.

ROOM HEATERS:

Room Heaters are of heavy cast iron construction with galvanized iron casings. For arrangement of the castings and casing, see Plate No's 148 and 149. The cold air is drawn from the floor through the space just below the casing and is delivered heated, through the top of the casing, where it is deflected to all parts of the room.

The Rating of Room Heaters is expressed in terms of grate diameter and is based upon the area of the grate, the heating surface and the weight.

The sizes of Room Heaters used are from 14 inch diameter grate to 28 inch diameter grate, inclusive. The assumptions made in determining the capacity, are indicated in table which follows this subject.

Room Heaters are generally placed directly in the center of the room to be heated. In the case of a two story barrack, the heater on the second floor is placed directly above the heater on the first floor. Each heater has a separate smoke pipe and where the smoke pipe runs through the floor or ceiling a thimble should be provided; a special roof flashing is installed where the smoke pipe goes through the roof.

WARM AIR FURNACES AND PIPELESS FURNACES:

Warm Air Furnaces and Pipeless Furnaces are both of heavy cast iron construction but differ in the type of casings with which they are inclosed. Illustrations showing the arrangement of castings and casings, are shown on Plate No's 148 and 149.

Warm Air Furnaces are generally used in Construction Division housing projects. The furnace is placed in a central location in the basement of the house to be heated. The cold air is drawn from outdoors through an opening placed below the grate line and the heated air is conducted from the furnace, by light weight tin or galvanized iron pipes, to the various rooms in the house. A recirculating connection which provides for using indoor air should also be provided.

Pipeless Furnaces used by this office have been limited to heating the second floor of buildings which are divided off into several rooms. The furnace is placed on the first floor, in such location, that the heated air may be discharged into the corridors of the second floor.

The rating of Warm Air Furnaces and Pipeless Furnaces is expressed in terms of grate diameter and is based upon the area of the grate, the heating surface and the weight.

The sizes of Warm Air Furnaces and Pipeless Furnaces used are from 14 inch diameter grate to 28 inch diameter grate, inclusive.

CANNON STOVES:

Cannon Stoves are of heavy cast iron construction, with plain surfaces, large fire-doors and deep fire-pots. An illustration is given on Plate No. 149. Cannon stoves heat by direct radiation and are usually placed in small rooms and work rooms.

The rating of cannon stoves is expressed in terms of grate diameter and is based upon the area of the grate, the heating surface and the weight.

The sizes of Cannon Stoves used are from 7 inch diameter grate to 16 inch diameter grate, inclusive. The assumptions made in determining the capacity are indicated in the table which follows:

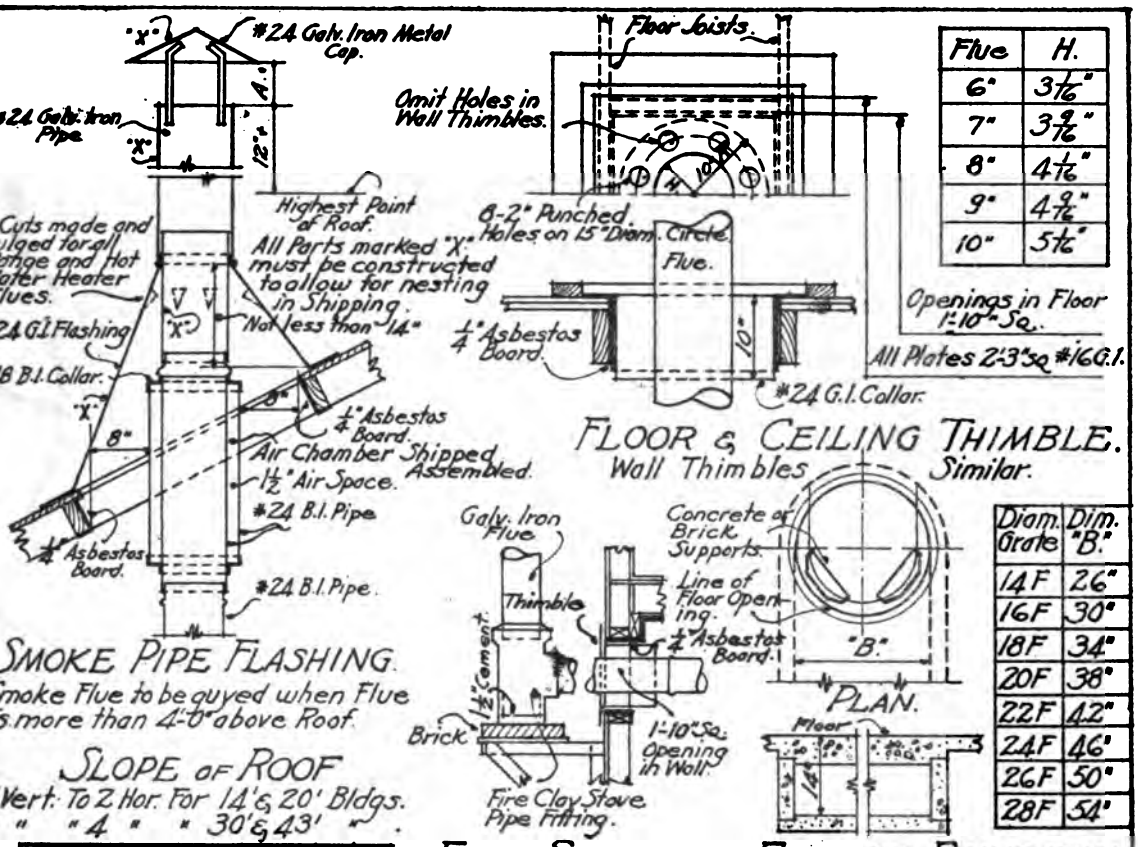
CAPACITY TABLE ROOM HEATERS AND CANNON STOVES.

Firepot Diam. Inches.	Grate Diam. Inches.	Grate Area sq. ft.	Pounds of Coal per hr. per sq. ft of Grate Area.	Calorific Value of Coal, B. T. U. per lb.	Thermal Efficiency of Heater per cent.	No. of B. T. U. per hour delivered by Stove.
			Cannon Stoves.			
10	7	.268	4.5	12000	50	8000
12	9	.443	5	12000	50	14000
14	10	.545	5	12000	50	17000
16	12	.785	5.5	12000	60	32000
18	14	1.07	5.5	12000	60	43000
20	16	1.4	6	12000	60	61000
			Room Heaters.			
18	14	1.07	5.5	12000	60	43000
20	16	1.4	6	12000	60	61000
22	18	1.77	6	12000	60	77000
24	20	2.18	6	12000	60	95000
26	22	2.64	6.5	12000	60	124000
28	24	3.14	6.5	12000	60	148000
30	26	3.7	7	12000	60	187000
32	28	4.28	7	12000	60	215000

The capacities of Warm Air Furnaces and Pipeless Furnaces may be determined in a manner similar to that followed in the case of Room Heaters. In choosing the proper size of furnace, due consideration must be given, however, to the facts that radiation from casing is generally ineffective and that air entering casing may be much lower in temperature than in the case of Room Heaters.

The fire hazard involved by the use of stoves and furnaces has been reduced to a minimum by the establishment of standard "Instructions for Installation and Erection," which have been approved by the Advisory Engineer on Fire Protection, detailed by the National Board of Fire Underwriters, to this office. These instructions are given on sheets No's 620-329, 620-330 and 6316-101 in the files of the Construction Division and certain details of installation are shown on Plate No. 147.

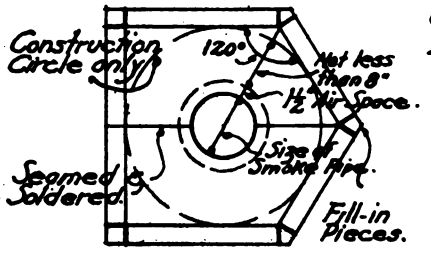
Note: In addition to the above, "Instructions for Installation and Erection" are given on the sheets noted, for: Army Ranges, Family Ranges, Gas Ranges, Tank Heaters, and Gas Heaters.


#24 Galv. Iron Metal Cap.
#24 Galv. Iron Pipe
Highest Point of Roof.
All Parts marked "X" must be constructed to allow for nesting in Shipping.
Not less than 14"
6 Cuts made and bulged for all Range and Hot Water Heater Flues.
#24 G.I. Flashing
#18 B.I. Collar.
8"
1/4" Asbestos Board.
Air Chamber Shipped Assembled.
1 1/2" Air Space.
#24 B.I. Pipe
#24 B.I. Pipe.
SMOKE PIPE FLASHING.
Smoke Flue to be guyed when Flue is more than 4'-0" above Roof.
SLOPE OF ROOF
1 Vert. To 2 Hor. For 14' & 20' Bldgs.
1 " " 4 " " 30' & 43' "
Omit Holes in Wall Thimbles.
Floor Joists.
6-2" Punched Holes on 15" Diam. Circle.
Flue.
10"
#24 G.I. Collar.
Openings in Floor 1'-10" Sq.
All Plates 2'-3" Sq. #16 G.I.
FLOOR & CEILING THIMBLE.
Wall Thimbles Similar.
Galv. Iron Flue
Thimble
1/4" Asbestos Board.
1 1/2" Cement
Brick
1'-10" Sq. Opening in Wall
Fire Clay Stove Pipe Fitting.
Concrete or Brick Supports.
Line of Floor Opening.
"B"
PLAN.
Floor
14"

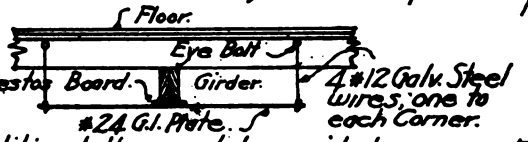
Flue	H.
6"	3 1/16"
7"	3 9/16"
8"	4 1/16"
9"	4 9/16"
10"	5 1/16"

Diam. Grate	Dim. "B."
14 F	26"
16 F	30"
18 F	34"
20 F	38"
22 F	42"
24 F	46"
26 F	50"
28 F	54"

Stove Pipe.	6"	7"	8"	9"	10"
Diam. of Cap.	12"	14"	16"	18"	20"
Dimension "A"	4"	5"	5"	6"	6"

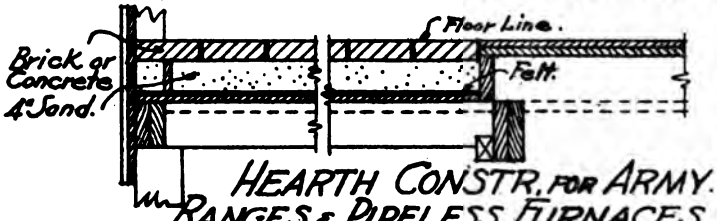


PLAN OF FLASHING.
Flange out 4" on all sides. Flange to be formed by bending. Cuts pieced and made only at points shown. Fill-in Pieces Seamed & Soldered in place.

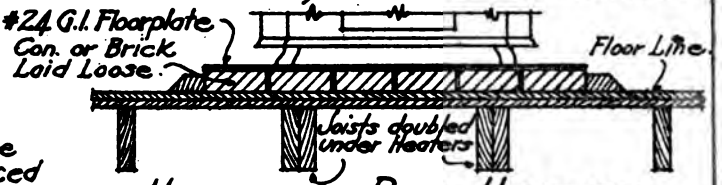


Additional Hangers to be provided where plate is seamed.
DEFLECTOR PLATE TYPE "A."

FLUE SUPPORT FURNACE FOUNDATION



HEARTH CONSTR. FOR ARMY RANGES & PIPELESS FURNACES



HEARTH FOR ROOM HEATERS.

DEFLECTOR PLATE TYPE "B."

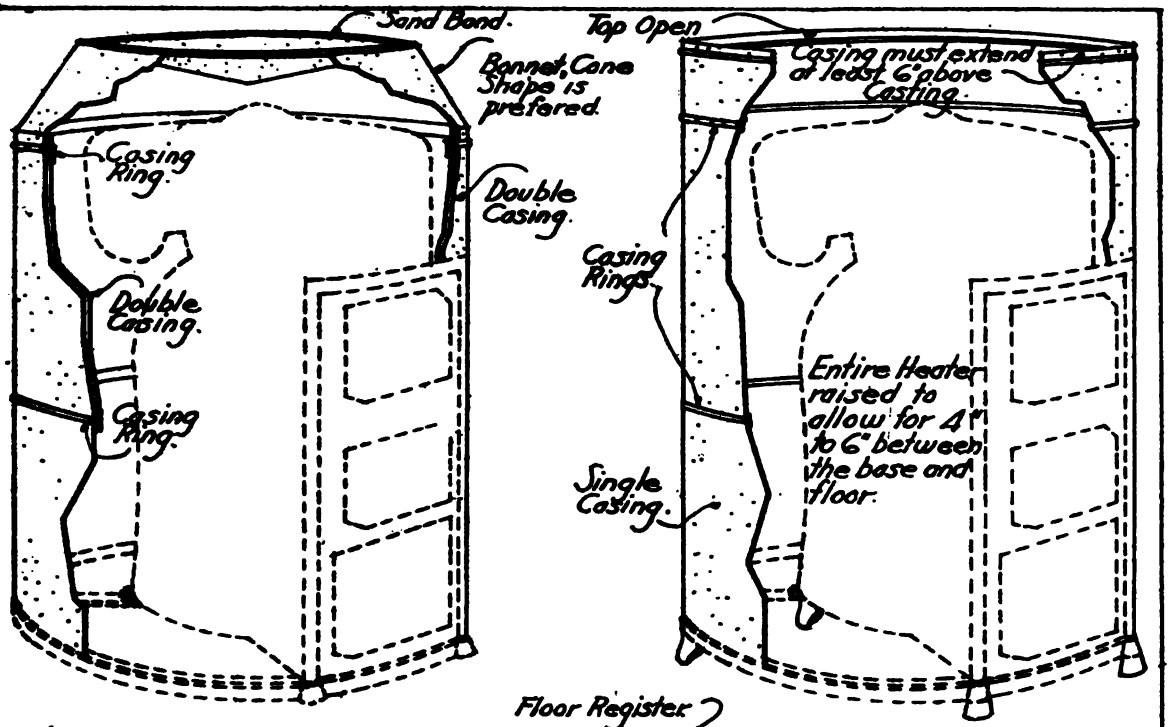
Size of Deflect Pl.	5'-0" Sq.	5'-3" Sq.	5'-6" Sq.	5'-9" Sq.	6'-0" Sq.	6'-6" Sq.	7'-0" Sq.	7'-0" Sq.
Size of Heater.	14 R.	16 R.	18 R.	20 R.	22 R.	24 R.	26 R.	28 R.

For Original, See Drawings 620-329, 629-330 & 6316-101.

CONSTRUCTION DIVISION OF THE ARMY

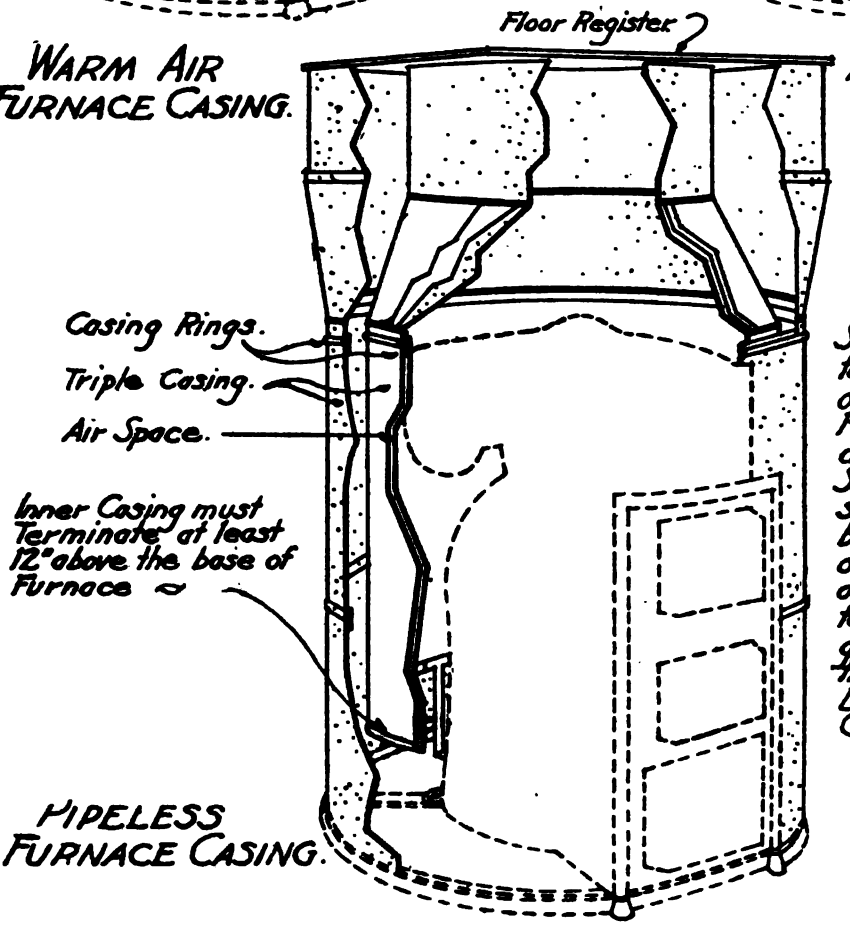
DETAILS

FOUNDATION HEARTHS THIMBALS FLUE SUPPORT DEFLECTOR PLATES SMOKE PIPE FLASHINGS



WARM AIR FURNACE CASING.

ROOM HEATER CASING



PIPELESS FURNACE CASING.

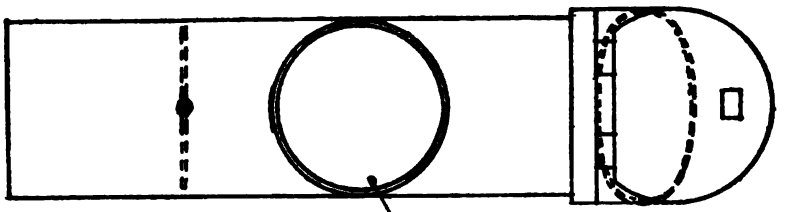
NOTE.

See Sheet on Casings for the Construction of Room Heaters and Furnaces also the detail of Cast Iron Smoke Pipe Tee and support which must be provided as part of each. Specifications and Instructions for installation are given elsewhere in this Manual. Dotted Lines show Castings.

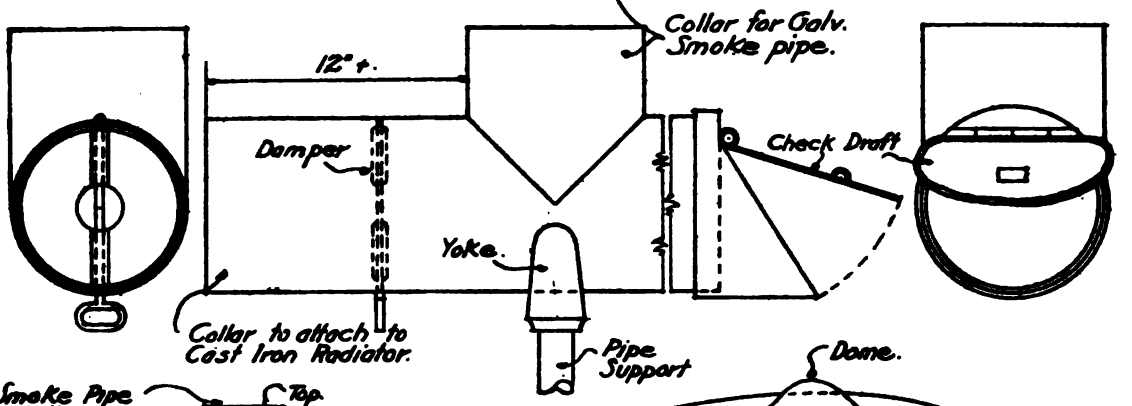
CONSTRUCTION DIVISION OF THE ARMY

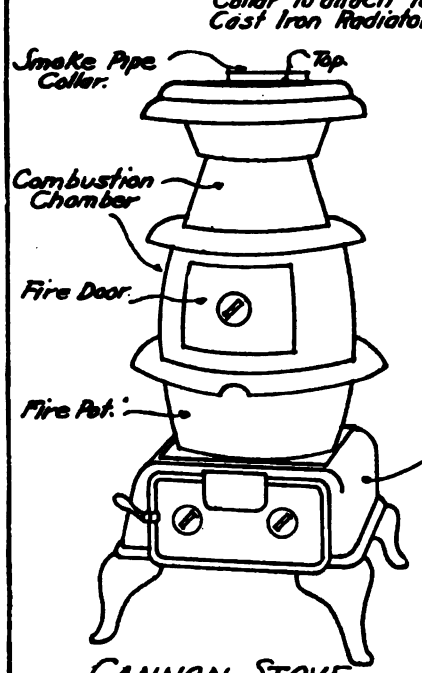
CASINGS

WARM AIR FURNACE · ROOM HEATER PIPELESS FURNACE CSGS



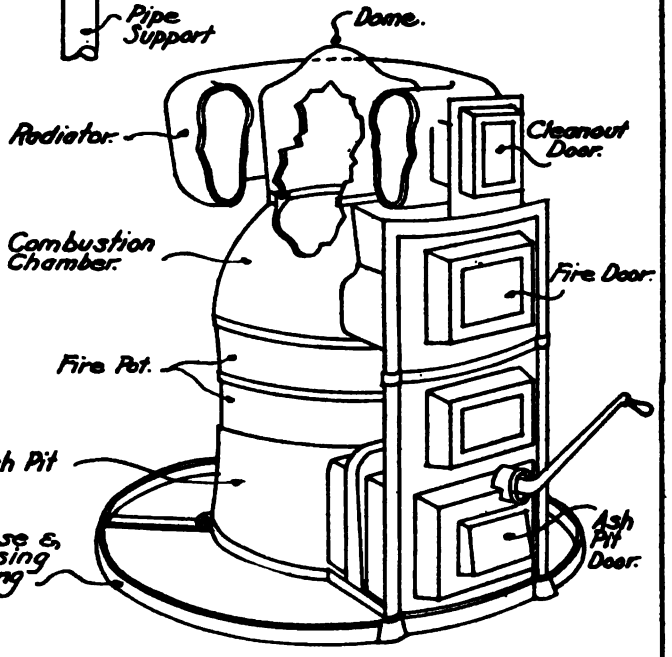
CAST IRON TEE AND DAMPER FOR WARM AIR HEATER AND FURNACE.





CANNON STOVE.

Cannon Stoves range in size from 7" Diam. grate to 16" Diam. grate. Measured at grate line, And range in weight from Approx. 75 lbs. to Approx. 350 lbs. in accordance with the size.



HEATER AND FURNACE.

Room Heaters & Furnaces range in size from 14" Diam. grates to 28" Diam grates measured at grate line, And range in weight from Approx. 650 lbs. to Approx. 1800 lbs. in accordance with Size.

NOTE. See Sheet on Casings for the Type of Casing used for Room Heaters & Furnaces Specifications & Instructions for Installation are given elsewhere in this manual.

CONSTRUCTION DIVISION OF THE ARMY

CASTINGS

CAST IRON SMOKE PIPE TEE · CANNON STOVE · HEATER & FURNACE

LAUNDRIES.

CAMPS AND CANTONMENTS:

Laundry machinery for camps and cantonments, is at present designed and scheduled by the Salvage Division, of the Purchase, Storage and Traffic Division of the General Staff.

Laundry buildings are, however, erected, and all laundry equipment is installed therein by the Construction Division; which also designs and installs steam generating, heating and plumbing equipment.

Plate No. 68 shows floor plan and machinery layout of a camp laundry designed to accommodate from 10,000 to 20,000 men.

Plate No. 67 shows schedule of laundry buildings of various capacities.

Following is a tabulation showing the steam and hot water requirements in connection with laundries of various sizes.

TABLE OF CAPACITIES.

Based on One 8-Hour Shift per Day.

Units (Men)	1,000-2,000	5,000-10,000	10,000-20,000	20,000-40,000
Gals. Cold Water per Hour	600	1800	4200	6500
Gals. Hot Water per Hour (190° F.)	500	1500	3600	5400
Boiler Horse Power for Laundry Mach.	30	75	140	175
Boiler Horse Power for Water Heating	18	52	125	190
Boiler Horse Power for Heating	5-10	15-30	35-70	50-100
Total Boiler Horse Power	53-58	142-157	300-335	415-465

Note: Steam required for heating varies with the outdoor temperature conditions encountered.

Laundries are not provided in connection with hospitals at camps or cantonments where camp laundries are available. General hospitals, when constructed at a distance from any camp or cantonment, are usually provided with laundries.

Following is a list of Laundry Equipment which should be provided for hospital work to accommodate 1,000 men:

Based on an eight hour working day and six days per week.

1—40 in. x 96 in. cylindrical Washer.

1—36 in. Underwear Solid Curb Extractor with belted motor.

1—60-gal. Soap Tank.

1—30 in. x 42 in. reversing type, motor driven Drying Tumbler.

1—100 in. three roll Flat Work Ironer.
1—Motor driven Marking Machine.
1—Motor driven Sewing Machine.
2—38 in. Clothes Presses.
3—Wooden Truck Tubs mounted on casters.
6—Wood bottom Laundry Baskets on casters.
2—Ironing Tables with electric irons and suspension bracket.
2—54 in. Stationary Two-part Laundry Tubs.
1—15-gal. Starch Cooker.
1—3 ft. x 6 ft. Zinc covered Starch Table.
1—40-gal. Bleach Jar.
1—36 in. x 54 in. x 96 in. Disinfector with formaldehyde generator.
1—34 in. x 50 in. Sterilizer Washer.

REFRIGERATION.

PRELIMINARY:

The following considerations or suggestions are not to be taken as adequate information for designing or constructing Refrigerating and Ice Making Plants. Detailed drawings and specifications for the standard plants, in the files of the Construction Division, must be used and may be obtained on application to the Washington Office.

COLD STORAGE PLANTS:

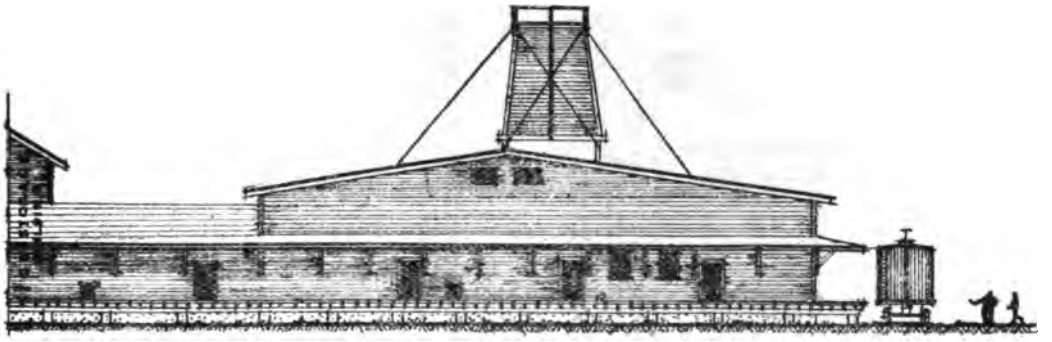
Provisions for cold storage or ice-making equipment and storage at cantonments or camps should be made only after a careful survey of conditions at the camp in question. Careful consideration as to present and future needs should be given. Cold storage and ice-making are widely different problems, and should be studied as such. A general standardization of plants has been made, based partly on camp population, and a tabulation thereof shown on Plate No. 150, includes the fourteen general types recommended. The capacities are more or less elastic, so that a moderate increase in the population of the camp would not necessitate an increase in refrigeration capacity. This is particularly true of cold storage facilities, as increase may be provided for by more frequent purchases by the Sub-Depot Quartermaster. Each storage building as shown on the tabulation provides for 2½ to 3 days provisions for the corresponding population. Thus Type "A" plant will furnish sufficient cold storage for a camp of twenty-five to thirty thousand men. Type "D" plant provides the same storage space and in addition has ice-making equipment of 15 tons raw water ice per twenty-four hours. Type "M" is typical of Refrigerating and Ice Making plants for camps, described on Plate No. 150 and shown on Plate No. 151.

ICE-MAKING EQUIPMENT:

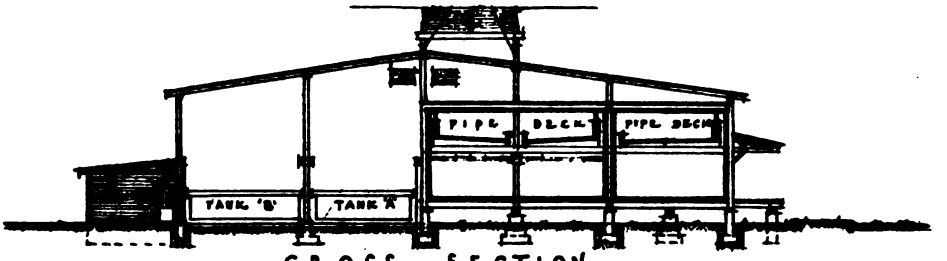
The installation of ice-making equipment in camps or cantonments is rather more complex than cold storage plants and requires careful consideration. In general, if ice is available at a price equivalent to, or less than that at which the Government can produce it (due allowance

DESCRIPTION OF REFRIGERATING AND ICE MAKING PLANTS
REFRIGERATION SECTION ... CONSTRUCTION DIVISION ... WAR DEPT.

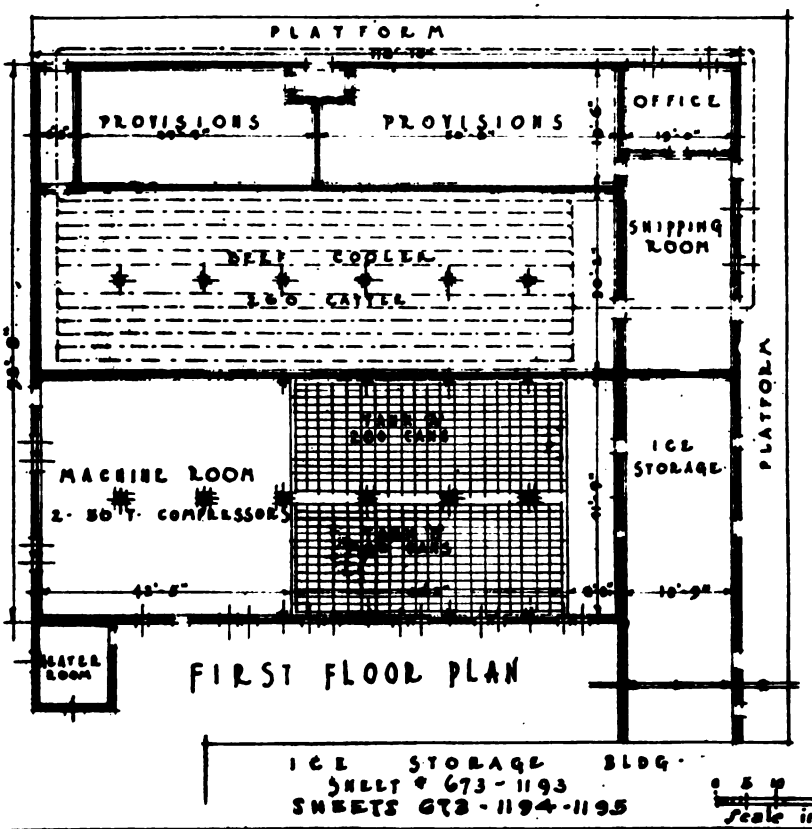
TYPE PLANT		A	B	C	D	E	F	G	J	K	L	M	N	O	P
		30,000 ICE CAP.	40,000 ICE CAP.	40,000 ICE CAP.	50,000 ICE CAP.	30,000 ICE CAP.	10,000 ICE CAP.	20,000 ICE CAP.	50,000 ICE CAP.	50,000 ICE CAP.	60,000 ICE CAP.	60,000 ICE CAP.	70,000 ICE CAP.	70,000 ICE CAP.	100,000 ICE CAP.
BUILDING	OVER ALL SIZE AND CAPACITY	35'-4" x 100'-0" 16'-0" x 32'-2" 15 TONS ICE MAKING	40'-10" x 100'-0" 16'-10" x 33'-2" 20 TONS ICE MAKING	45'-9" x 100'-0" 18'-9" x 32'-1" 25 TONS ICE MAKING	48'-6" x 100'-0" 19'-4" x 32'-8" 25 TONS ICE MAKING	37'-2" x 100'-0" 16'-6" 15 TONS ICE MAKING	24'-0" x 36'-6" 8 TON ICE MAKING	41'-8" x 36'-6" 3 TON ICE MAKING	51'-5" x 100'-0" 20'-0" x 33'-2" 33 TONS ICE MAKING	48'-0" x 100'-0" 20'-0" x 32'-2" 35 TONS ICE MAKING	37'-4" x 100'-0" 16'-0" x 32'-2" 45 TONS ICE MAKING	51'-2" x 100'-0" 21'-6" x 32'-2" 50 TONS ICE MAKING	51'-5" x 100'-0" 21'-6" x 33'-2" 50 TONS ICE MAKING	52'-0" x 100'-0" 21'-6" x 33'-2" 60 TONS ICE MAKING	83'-0" x 70'-0" 67 TONS ICE MAKING
BELT D	SIZE ROOM	81'-4" x 18'-1" 14'-6" HIGH	84'-0" x 23'-2" 14'-6" HIGH	84'-6" x 23'-2" 14'-6" HIGH	84'-6" x 18'-6" 14'-0" HIGH	81'-6" x 18'-6" 14'-0" HIGH	46'-6" x 14'-6" 14'-0" HIGH	25'-5" x 14'-11" 14'-0" HIGH	83'-3" x 30'-3" 14'-6" HIGH	83'-0" x 30'-2" 14'-6" HIGH	97'-5" x 30'-2" 14'-6" HIGH	97'-5" x 30'-2" 14'-6" HIGH	81'-7" x 30'-2" 14'-6" HIGH	81'-7" x 30'-2" 14'-6" HIGH	46'-0" x 14'-6" 14'-0" HIGH
	NO. OF CATTLE	110 to 140	160 to 200	160 to 200	110 to 140	110 to 140	60 to 70	30 to 35	220 to 260	220 to 260	260 to 300	260 to 300	300 to 340	300 to 340	60 to 70
PROVISIONS NO. 1	SIZE ROOM	40'-6" x 14'-6" 14'-0" HIGH	43'-0" x 14'-6" 14'-6" HIGH	43'-0" x 14'-6" 14'-6" HIGH	40'-6" x 14'-6" 14'-0" HIGH	37'-0" x 14'-6" 14'-0" HIGH	22'-2" x 14'-6" 14'-0" HIGH	15'-7" x 14'-7" 14'-0" HIGH	21'-9" x 18'-6" 14'-6" HIGH	21'-9" x 18'-6" 14'-6" HIGH	30'-0" x 18'-6" 14'-6" HIGH	30'-0" x 18'-6" 14'-6" HIGH	33'-0" x 18'-6" 14'-6" HIGH	33'-0" x 18'-6" 14'-6" HIGH	22'-2" x 14'-6" 14'-0" HIGH
	CARS PROVISIONS	1½-2	1½-2	1½-2	1½-2	1½-2	1-2	1	2-2½	2-2½	2½-3	2½-3	3-3½	3-3½	1-2
	D-E PIPE 2"	775'	950'	950'	775'	750'	650'	375'	850'	850'	1300'	1300'	1350'	1350'	650'
PROVISIONS NO. 2	D-E PIPE 2"	625'	750'	750'	625'	750'			850'	850'	1035'	1035'	1350'	1350'	
	SIZE ROOM	34'-6" x 14'-6" 14'-0" HIGH	34'-0" x 14'-6" 14'-6" HIGH	34'-0" x 14'-6" 14'-6" HIGH	34'-0" x 14'-6" 14'-0" HIGH	27'-6" x 14'-6" 14'-0" HIGH			27'-9" x 18'-6" 14'-6" HIGH	27'-9" x 18'-6" 14'-6" HIGH	34'-6" x 18'-6" 14'-6" HIGH	34'-9" x 18'-6" 14'-6" HIGH	52'-0" x 18'-6" 14'-6" HIGH	52'-0" x 18'-6" 14'-6" HIGH	
	CARS PROVISIONS	1½-2	1½-2	1½-2	1½-2	1½-2			2-2½	2-2½	2½-3	2½-3	3-3½	3-3½	
ICE - STORAGE	D-E PIPE 2"	2580'	1830'	3080'						3650'		4120'		4820'	
HOUSE STORAGE	SIZE ROOM	47'-3" x 34'-6" 26'-0" HIGH	31'-6" x 34'-6" 26'-0" HIGH	63'-0" x 34'-6" 26'-0" HIGH						18'-9" x 34'-6" 26'-0" HIGH		94'-6" x 34'-6" 26'-0" HIGH		110'-3" x 34'-6" 26'-0" HIGH	
	CAPACITY TONS	1000 T	750 T	1250 T						1500 T		1750 T		2000 T	
	VE STIBULL PIPE 2"	290'	262'	290'						360'		360'		394'	
	D-E PIPE 2"	2580'	1830'	3080'						3650'		4120'		4820'	
	SIZE ROOMS	47'-3" x 34'-6" 26'-0" HIGH	31'-6" x 34'-6" 26'-0" HIGH	63'-0" x 34'-6" 26'-0" HIGH						18'-9" x 34'-6" 26'-0" HIGH		94'-6" x 34'-6" 26'-0" HIGH		110'-3" x 34'-6" 26'-0" HIGH	
	CAPACITY TONS	1000 T	750 T	1250 T						1500 T		1750 T		2000 T	
DAILY STORAGE	D-E PIPE 2"	480'	500'	520'						531'		590'		661'	640'
	SIZE ROOM	15'-2" x 32'-0" 10'-0" HIGH	20'-6" x 31'-6" 10'-0" HIGH	17'-0" x 32'-6" 10'-0" HIGH						17'-0" x 26'-6" 10'-0" HIGH		18'-9" x 42'-0" 10'-0" HIGH		16'-9" x 42'-0" 10'-0" HIGH	31'-8" x 17'-0" 10'-0" HIGH
	CAPACITY TONS	33 TONS	46 TONS	46 TONS						46 TONS		58 TONS		58 TONS	50 TONS
COMPRESSORS	SIZE	2 SECTIONS 20" x 12" P.H.	3 SECTIONS 20" x 12" P.H.	6 SECTIONS 20" x 12" P.H.	5 SECTIONS 20" x 12" P.H.	7 SECTIONS 20" x 12" P.H.	100 FT. 2" Pipe	60 FT. 1¾" & 2" PIPE	5 SECTIONS 20" x 12" P.H.	10 SECTIONS 20" x 12" P.H.	5 SECTIONS 20" x 12" P.H.	13 SECTIONS 20" x 12" P.H.	4 SECTIONS 20" x 12" P.H.	15 SECTIONS 20" x 12" P.H.	4 SECTIONS 20" x 12" P.H.
	KIND	ATMOSPHERIC BLEEDER	ATMOSPHERIC BLEEDER	ATMOSPHERIC BLEEDER	ATMOSPHERIC BLEEDER	ATMOSPHERIC BLEEDER	ATMOSPHERIC BLEEDER	DOUBLE PIPE	ATMOSPHERIC BLEEDER	ATMOSPHERIC BLEEDER	ATMOSPHERIC BLEEDER	ATMOSPHERIC BLEEDER	ATMOSPHERIC BLEEDER	ATMOSPHERIC BLEEDER	ATMOSPHERIC BLEEDER
	DISPLACEMENT CU. INCHES PER MINUTE	123.000	164.000	205.000 EACH	164.000 EACH	1-164.000 1-287.000	49.000	24.600	205.000	1-205.000 1-410.000	205.000	410.000 EACH	246.000	492.000 EACH	1-82.000 1-164.000
	TONS CAPACITY	15 T.	20 T.	2-25 T	2-20 T.	1-20 T. 1-35 T.	6 T.	3 T.	25 T.	1-25 T. 1-50 T.	25 T.	2-50 T.	30 T.	2-60 T.	1-10 T. 1-20 T.
	NO. MACHINES	1	1	2	2	2	1	1	1	2	1	2	1	2	2
ICE MAKING TANKS	NUMBER			2	2	2				2		2		2	1
	SIZE			EACH 31'-0" x 14'-0" 5'-3" HIGH	EACH 24'-5" x 12'-9" 4'-0" HIGH	EACH 18'-3" x 36'-0" 5'-3" HIGH				EACH 35'-3" x 16'-3" 5'-3" HIGH		EACH 18'-9" x 36'-0" 5'-3" HIGH		EACH 16'-0" x 36'-3" 6'-3" HIGH	15'-9" x 28'-3" 5'-3" HIGH
ICE MAKING CANS	NUMBER			335 100 PER TANK	245 120 PER TANK	316 100 PER TANK				360 180 PER TANK		430 220 PER TANK		492 240 PER TANK	125 150 PER TANK
	SIZE			11"x 22"x 57" 400# CAKE	11"x 22"x 44" 300# CAKE	11"x 22"x 57" 400# CAKE				11"x 22"x 57" 400# CAKE		11"x 22"x 57" 400# CAKE		11"x 22"x 57" 400# CAKE	11"x 22"x 57" 400# CAKE
DIST. WATER PUMPS	POWER			2 HAND	2 HAND	2 HAND				2 HAND		2 HAND		2 HAND	1 HAND
	CAPACITY	30 G.P.M.	60 G.P.M.	180 G.P.M.	120 G.P.M.	166 G.P.M.	30 G.P.M.		75 G.P.M.	225 G.P.M.	75 G.P.M.	300 G.P.M.	90 G.P.M.	360 G.P.M.	100 G.P.M.
	HEAD	50 FT.	50 FT.	50 FT.	50 FT.	50 FT.	30 LBS.		50 FT.	50 FT.	50 FT.	30 LBS.	50 FT.	50 FT.	50 FT.
MOTORS	COMBINED	1-30 H.P.	1-40 H.P.	2-50 H.P.	2-40 H.P.	1-40 H.P. 1-75 H.P.	1-10 H.P.	1-7½ H.P.	1-50 H.P.	1-100 H.P. 1-50 H.P.	1-50 H.P.	2-100 H.P.	1-50 H.P.	2-100 H.P.	1-40 H.P. 1-20 H.P.
PLANT LINE	NO.	673-1016 TO 1019 INCL.	673 1015 1020 1021	673-1010 TO 1014 INCL.	673-1006 TO 1009 INCL.	673-1212 1213	820-471 472 473	673-1210 1211	673-1200 1201	673-1196 1197	673-1198 1199	673-1194 1195	673-1202 1203	673-1210 1209	673-1217 1218



END ELEVATION



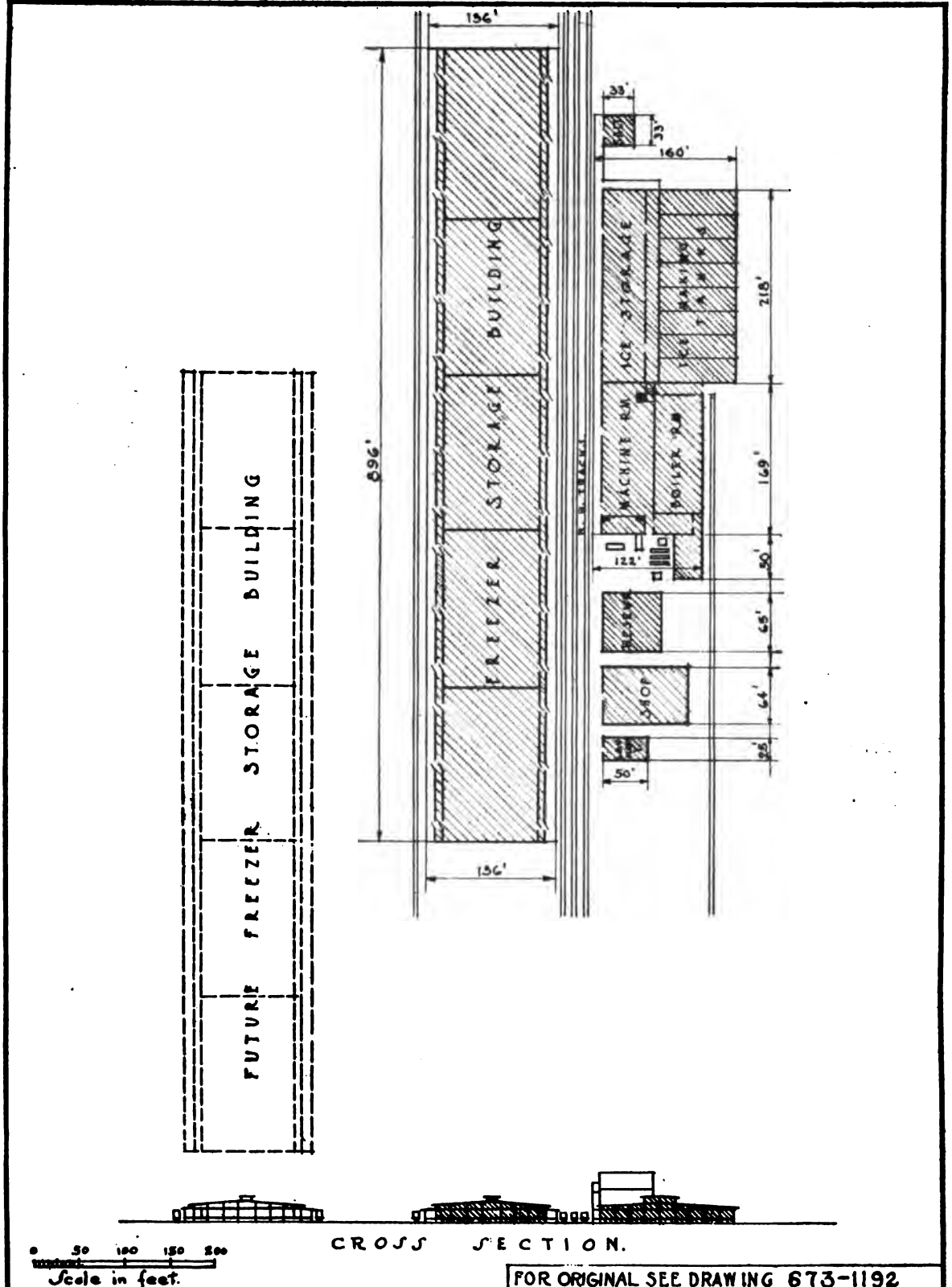
CROSS SECTION



ICE STORAGE BLDG.
SHEET # 673-1193
SHEETS 673-1194-1195

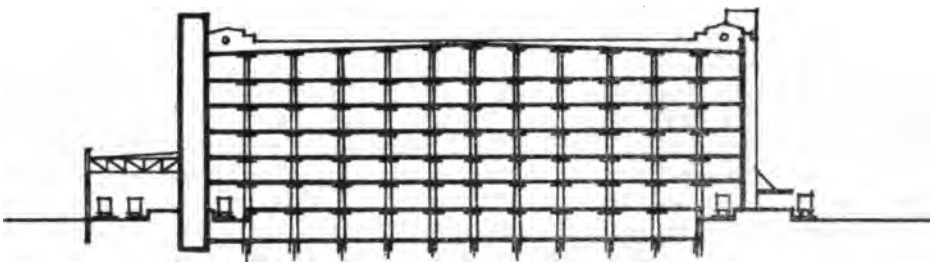
0 5 10 20 30
scale in feet

CONSTRUCTION DIVISION OF THE ARMY
REFRIGERATING & ICE MAKING PLANT
TYPE "M"

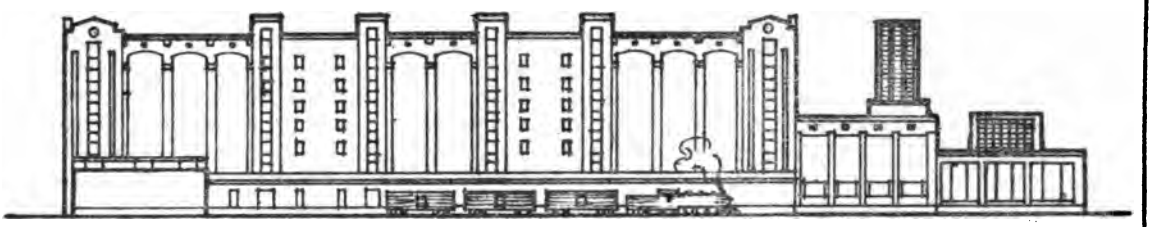


FOR ORIGINAL SEE DRAWING 673-1192

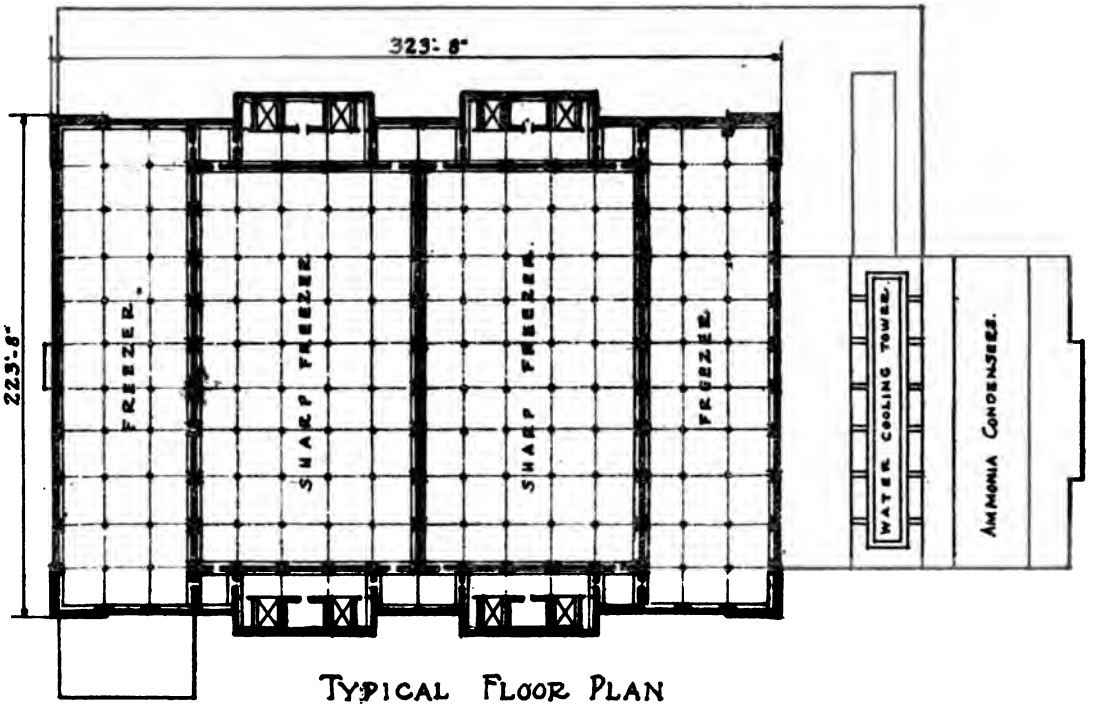
CONSTRUCTION DIVISION OF THE ARMY
REFRIGERATION SECTION
COLD STORAGE & ICE MAKING PLANT A.E.F. FRANCE



SECTION



ELEVATION



TYPICAL FLOOR PLAN

SCALE OF FEET.

100 80 60 40 20 0 100

CONSTRUCTION DIVISION OF THE ARMY
REFRIGERATION SECTION
SHARP FREEZER & FREEZER STORAGE & ICE MAKING PLANT
CHICAGO, ILL. U.S.A.

being made for depreciation, interest, cost of operation and power), there is no need for ice-making equipment. If it is found that the cost of available ice is excessive, that there is no prospect of a reduction in cost, and that the camp can manufacture ice for a considerable period at a saving to the Government, the construction of an ice-making plant is justified. The capacity of such a plant must be carefully determined. Ice consumption, aside from that of the main cold storage plant, varies throughout the year and according to the location of the camp. In the northern camps, the average per capita consumption per year is approximately one pound per day, varying from three-tenths of a pound in the winter months, to a trifle less than two pounds in July and August. In the southern camps, the consumption per capita per day is approximately double the figures given above. Thus referring to the tabulation, a Type "D" plant making 15 tons (30,000 lbs.) of ice per twenty-four hours, will be sufficient for both the cold storage and ice-making requirements of a northern camp, having a population of twenty-five thousand to thirty thousand men, while a camp of the same size in the south, would require a Type "E" plant having the same cold storage space but ice-making capacity of 25 tons per twenty-four hours, provided an ice-storage building is installed of proper size to stabilize the yearly load curve of the plant. Thus by installing ice-making equipment sufficient to produce a little more than the average daily ice requirements (this average being taken over the entire year) and an ice-storage house of sufficient capacity to store the surplus produced in running the plant to full capacity during the cold weather, and drawing on this ice-storage during the summer months, a well balanced ice plant sufficient to supply the demands during the entire year, is provided. Drawing 673-1098 in the files of the Construction Division shows the present standard type of ice-storage house. This drawing provides for houses of any desired capacities.

ICE-STORAGE:

Special consideration should be given to the climatic conditions in any locality, as it is very evident that an ice-storage house would not be a good investment in some of the southern localities where there is practically no cold weather. In this case, a plant having sufficient ice-making capacity for the full summer needs should, be provided and so designed, that when the demand falls off, one or more compressors may be shut down and the production reduced.

POWER:

The selection of the driving units, may be established on the basis of fuel and transmission charges. In general, electric-driven units are simpler, less expensive, and more efficient as to prime mover than steam-driven units. The only condition warranting steam engine drive, is where there is an all-the-year demand for exhaust steam, or, for any reason the electric power cost is excessive while the fuel cost is not proportionately high, and in this event, it is well to consider the absorption system or still better, a combination of steam-driven compression and absorption system. The selection in the latter case should be referred to competent refrigeration engineers.

COLD STORAGE AND ICE-MAKING PLANTS FOR THE AMERICAN EXPEDITIONARY FORCES.

The Construction Division designed, assembled and arranged for shipment to France all materials and equipment for several large cold storage and ice-making plants. Sufficient cold storage capacity was planned to provide 30 days reserve rations of fresh beef. In designing these plants, three main points where considered as most essential:

1. Unquestioned continuity of operation;
2. Time required for construction;
3. Rapid handling of product in and out of plant.

With these main points in mind the plants have been designed as shown on typical layout, see Plate No. 152. Steam-driven ammonia compressors, with ample reserve capacity were provided. This type was selected because Corliss engine driven compressors are the best known and most dependable type. Fire tube boilers were used since they are dependable, self-contained and can be erected in the shortest time. The alternators provided are direct connected, steam engine driven.

The plant pumping station was located near the water supply, and was provided with two large direct-connected, electric driven, centrifugal pumps, with transformers and transmission lines to operate, either from energy received from the main plant or from a high tension transmission line near the pumping station. Two large gasoline engine-driven centrifugal pumping units were also provided in case of failure of both sources of electric energy.

With the single story type of construction, a maximum number of cars can be set at the loading or unloading docks at one time and the product handled in and out of the cold storage rooms on the same level without the use of elevators and their consequent delays. Trackage facilities were provided on both sides of the cold storage building as well as for the boiler room and ice making plant.

The plants were similarly designed; the first plant with a storage capacity of 6,500 tons of frozen beef and an ice-making capacity of 500 tons per day, was built in five months. 150 cars can be handled at this plant during each day.

The frozen beef supply for the American Expeditionary Forces is obtained mostly from Chicago, and in order to insure adequate sharp and storage freezer facilities at this point, the Construction Division built in Chicago a plant with a capacity of 1300 tons of beef per day or 39,000 tons per month, and the capacity of the storage freezers is 13,000 tons. The tracking facilities are adequate to provide for 50 cars at one setting. Plate No. 153 shows typical floor plan, elevation and section of this plant.

ESTIMATES.

PRELIMINARY:

An estimate of cost is necessary before presenting a proposed construction project for approval. A complete and accurate analysis of each case should be made; as under-estimating causes delay and over-estimating results in needlessly tying up funds which should be used for other purposes.

Request and data for an estimate should be sent to the Expediting Officer, who through his assistant engineers, is in position to prepare it in proper form, supply much necessary information, and in general, facilitate the speedy preparation of the estimate and guide it through proper channels.

FUNCTIONS OF THE ESTIMATOR:

The work of the Estimator is divided as follows: First, the preparation of original estimates. Second, the checking of estimates made by Army representatives in the field; by other Army or Governmental Departments; or by civil organizations interested in Army projects.

DATA NECESSARY FOR MAKING OR CHECKING ESTIMATES:

(a) In the case of estimates for camp construction and hospitals, reference is made by number to the list of standard drawings, giving the number of each type of building required, stating the size or capacity of each, the number of men to be accommodated, and the total area of ground to be occupied by buildings. A list of all special buildings not covered by standard drawings should be made and these should be handled as described in paragraph (b). A statement as to all outside utilities, such as water-supply, sewerage and disposal of same, power, light, etc., should be included.

(b) For projects the nature of which is such that no standard drawings are available, complete plans should be prepared and furnished if possible, together with the other data above described in paragraph (a). Where plans cannot be furnished, closely approximate estimates can be made. For this purpose, as definite data as is possible should be given for each building, including the principal features, such as type of construction, story height, materials, character of walls, partitions, foundations, roof, interior supports, fire hazard, and fire-resisting characteristics, finish, etc. In each case full data should be given as to the nature of heat, light and plumbing requirements, including a plan or description of exterior utilities, sewer, water, electricity, paving, fencing, etc.

In order to check estimates made outside of this department, complete data should be furnished with such estimates as are described in paragraphs (a) and (b).

FIELD ESTIMATES:

Estimates made in the field, by other Governmental Departments or Divisions of the Army or by private individuals interested in Army projects, should be prepared in accordance with the instructions described under preceding heading, "Data Necessary," etc. In all cases such estimates should be sent to the Washington office for check. In case of doubt on the part of the Estimator as to values, local contractors of ability should be consulted.

VARIABLES TO BE CONSIDERED IN PREPARING ESTIMATES:

A great variation exists in different sections of the country in the cost of important items of building material, such as lumber. Labor also varies, but not always in ratio to the variation of material. Efficiency of labor is the most serious variable that must be taken into consideration in estimating. Labor inefficiency increases approximately in proportion to the demand for labor. The available supply of labor and the amount of over-time necessary to execute work with requisite speed must be considered; also measures necessary to prevent labor leaving for other places where more attractive conditions prevail, is a factor to be considered in labor cost. The item of turn-over or migration of labor from job to job is an expense difficult to express in money. Quarters, commissary and transportation arrangements, are factors affecting cost to be considered in estimating. Types of construction, and location with reference to climate, materially affect costs with respect to provisions for heat, etc. Local conditions also determine variations in cost of water supply, sewerage disposal, electric light and power service, road building and railroads.

METHODS:

Estimating for emergency military construction demands radical differences in methods from those used in civil practice. The cubic foot or square foot unit scheme of estimating becomes more unreliable and impracticable under war conditions than normally. The method in which actual quantities of every kind and the labor involved are figured, is too cumbersome and slow.

Estimates should be prepared for all typical buildings used in camps, including their exterior utilities. It is not to be expected that the standard values applied to such units, will remain fixed or be applicable in all localities. The estimates should be so prepared that where cost reports are available, the standard values may be adjusted by means of percentages, indicated by analysis of the cost report. The method used in preparing estimates should be such as will eliminate detail, reduce the structure to its main elements, such as floors, walls, roofs, partitions, foundations, etc., and place values upon such units, in accordance with the most recent information from the locality in which the project concerned is located. This system requires the assistance of men of experience and judgment in the handling of labor, as well as experience in practical estimating.

Due to the method herein explained, it will be seen that it is impracticable in most cases, to furnish detailed estimates, except at considerable delay, due to changes in method of figuring, back-checking, etc.

SUB-DIVISION OF ESTIMATES:

Estimates are prepared and divided as indicated on this sheet:

LOCATION _____ DATE _____

DESCRIPTION _____ DRAWING NO. _____

	$
B. & Q. (Barracks & Quarters)	
Buildings	
Refrigerators	
Fence	
.....	
R. S. (Regular Supplies)	
Heating	
Ranges	
Inside Electric	
Outside Electric	
Bakery Building	
Equip't & Install'n.....	
Laundry Building	
Equip't & Install'n.....	
Boiler House	
Equip't & Install'n.....	
Power Plant Bld'g.....	
Equip't & Install'n.....	
Refrigeration Bld'g.....	
Equip't & Install'n.....	
W. & S. (Water & Sewage)	
Water	
Sewerage	
Plumbing	
Fire Protection	
.....	
	$.....

	Forward $.....
M. P. E. (Military Post Exchange)	
Post Exchange School.....	
Lib., Gym. & Theatre.....	
.....	
R. W. W. & D. (Roads, Walks, Wharves & Drainage)	
Railroads	
Roads & Walks.....	
Wharves & Dred'g.....	
Clearing & Drainage.....	
.....	
C. & R. of H. (Construction & Repair of Hospitals)	
.....	
I. P. S. & S. F. (Inland Port Shipping & Storage Facilities)	
.....	
B. Q. S. C. D. (Barracks & Quarters, Seacoast Defenses)	
.....	
S. G. & R. (Shooting Galleries & Ranges)	
	TOTAL $.....

SCHEDULES OF MATERIALS.

CHARACTER AND PURPOSE.

CLASS A

Schedules for authorized or contemplated projects.

1. The primary object of these schedules is to facilitate the mobilization of materials by the Procurement Division.

2. They are made with a view towards the speedy delivery of the materials covered and are to be considered neither complete nor accurate. They do not include small items and are not generally made for small projects.

3. They are delivered by the Schedule Officer to the various Supervising Constructing Officers, who forward them to the Procurement Division attached to the necessary purchase authorizations, and at the same time should send copies to the Constructing Officer concerned.

4. The Constructing Officer should check the items in these schedules against the complete schedules of all materials necessary in connection with the project in question, which he should have made as early as possible (see paragraph 8 B); and make arrangements, through, or with the consent of the Supervising Constructing Officer, for the procurement and delivery of all such material not covered by the schedules furnished.

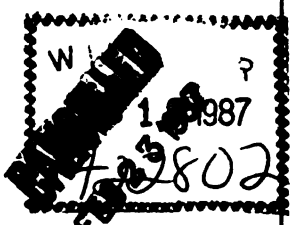
CLASS B

5. Schedules for individual buildings are made primarily as part of the process of making the schedules referred to in Class A, and are both more accurate and more in detail.

6. Sets of individual building schedules have been completed of Building Material, Heating and Electric Wiring covering all the Standard Cantonment Drawings, known as the 620 series.

7. Copies of the schedules mentioned in paragraph 5 and the sets of schedules mentioned in paragraph 6 are kept on file and can be had upon application to the Washington Office.

8. These schedules should be useful to the Constructing Officer, as follows:
   (a) In cases where schedules of Class A are not furnished.
   (b) For making his own bills of quantities.

3 2044 017 983 453

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